

Annual Report 2007

Project No. 1982-013-03  
Annual Stock Assessment - CWT (USFWS)

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## INTRODUCTION

In 1989 the Bonneville Power Administration (BPA) began funding the evaluation of production groups of juvenile anadromous fish not being coded-wire tagged for other programs. These groups were the "Missing Production Groups". Production fish released by the U.S. Fish and Wildlife Service (FWS) without representative coded-wire tags during the 1980s are indicated as blank spaces on the survival graphs in this report. This program is now referred to as "Annual Stock Assessment - CWT"

The objectives of the "Annual Stock Assessment" program are to:

- estimate the total survival of each production group,
- estimate the contribution of each production group to fisheries, and
- prepare an annual report for USFWS hatcheries in the Columbia River basin.

Coded-wire tag recovery information will be used to evaluate the relative success of individual brood stocks. This information can also be used by salmon harvest managers to develop plans to allow the harvest of excess hatchery fish while protecting threatened, endangered, or other stocks of concern.

All fish release information, including marked/unmarked ratios, is reported to the Pacific States Marine Fisheries Commission (PSMFC). Fish recovered in the various fisheries or at the hatcheries are sampled to recover coded-wire tags. This recovery information is also reported to PSMFC.

This report has been prepared annually starting with the report labeled "Annual Report 1994". Although the current report has the title "Annual Report 2007", it was written in fall of 2008 using data available from RMIS that same year, and submitted as final in January 2009. The main objective of the report is to evaluate survival of groups which have been tagged under this ongoing project.

This latest revision contains corrected Summary tables. These tables have now been calculated so that recoveries in Spawning Ground Surveys are no longer included in the Harvest column, and fish recovered at non FWS Hatcheries are included in the Hatchery column.

## METHODS

The Annual Stock Assessment Report reports coded-wire tagging for the most recently completed contract period, and evaluates the survival and contribution of fish tagged, raised and released at National Fish Hatcheries in the Columbia River Basin.

Release information used in this report is collected with the U.S. Fish and Wildlife Service Columbia River (information) System (CRiS). Information prior to the Columbia River Basin wide implementation of CRiS, and from USFWS hatcheries in Idaho, is obtained from the interagency Regional Mark Information System.

Lists of coded-wire tags are obtained from the CRiS sr80s file by use of the CWTetc program.

This currently involves the additional step of downloading Dworshak and Kooskia release information from the RMIS database, and adding it to the sr80s file.

Recovery information is obtained from the PSMFC Regional Mark Information System (RMIS) coded-wire tag database web site. This database is continuously being updated by the contributing agencies: California Fish and Game (CDFG), Canadian Department of Fisheries and Oceans (CDFO), Oregon Department of Fisheries and Wildlife (ODFW), Washington Department of Fisheries and Wildlife (WDFW), and US Fish and Wildlife Service (FWS); and the updates are reflected annually in this report.

Coded-wire tag recovery information is retrieved in the TS1 (Tag Summary) format. The TS1 report contains both the observed number of recoveries, and the estimated number of recoveries based on the sampling rate. The TS1 report is used precisely because it is a Summary. Individual recoveries of coded-wire tags used for this report number in the tens of thousands. Individual recovery sites for those codes number in the hundreds or thousands. The TS1 report groups, or summarizes, these recovery sites into broad categories based on combinations of geographic and other criteria.

It should also be noted that fisheries in some tributaries such as the Clackamas River, and its tributary Eagle Creek, are poorly sampled (or not at all) for recovery of coded-wire tags. Whereas, state agencies often rely on harvest estimates based on sport license returns in these tributaries, this information is not available through RMIS and the TS1 format.

TS1 reports were downloaded from RMIS in fall of 2008. These TS1 reports are downloaded in ASCII format. A dBASE V program transforms these ASCII files into a single dbf file.

A Stock Assessment Reference Document is prepared for each hatchery, brood year, and species. Because many fish were released without representative coded-wire tags before the Annual Stock Assessment program began, a single Production Expansion Factor (PEF - the total number of fish released divided by the total number of tagged fish released) is calculated for each hatchery, brood year, species, and stage of fish released. This PEF is used to expand estimated recovery information for non coded-wire tagged fish released along with tagged fish, and to determine the overall contribution and survival rate for each facility.

Until the late 1990s, the adipose fin was removed from all fish receiving a coded-wire tag. The missing adipose fin facilitated the recovery of tags from returning or harvested jacks and adults.

In the late 1990s the goal of protecting weak, threatened, or endangered

populations of fish, while maintaining fisheries on healthy populations, led to the removal of the adipose fin from most hatchery fish. The "mass marking" of hatchery steelhead, coho, and Chinook makes it possible to harvest only hatchery fish. Wild fish with adipose fins are not harvested in "selective fisheries". In order to assess the success of selective fisheries, some hatchery fish are given a coded-wire tag and the adipose fin is not removed. Fish without adipose fins may be harvested at different rates than fish with adipose fins. A new program that expands the recoveries for each coded-wire tag, rather than as an aggregate, was written. This program is used for most of the most recent brood years, and has now been used for many older brood years beginning with brood year 1990.

Stock Assessment Reference Summary printouts list the following information for each brood year, species, hatchery, and stage released at the hatchery: release information, the total number of observed recoveries, where recoveries occurred, the number of expanded recoveries from the PSMFC TS1 report, the number of recoveries expanded to include unmarked fish released, and a summary of where fish were recovered. The most recent brood years have been reprocessed, and all brood years for all hatcheries and species are included in this report. Text describing the major attributes of the contribution for each hatchery, species, and brood year is prepared and included in the report. Graphs of survival and relative proportion of recoveries in major areas are prepared and included in the report.

In November 2008 the program that summarizes data for the Fisheries graphs was amended to include harvest in the Estuary Sport fishery in the Columbia R. Sport numbers.

"Residualized" fish, or "mini-jacks" from yearling releases, are not included in estimates of survival.

## **RESULTS**

One hundred fifty-six "Annual Stock Assessment" tags were recovered at National Fish Hatcheries in 2008, while the number of fish tagged under this program was 175,437.

A brief description of the estimated survival and contribution for each species raised and released at national fish hatcheries follows. These descriptions are followed by graphs for each hatchery and species.

## **Carson National Fish Hatchery**

Carson National Fish Hatchery (NFH) is located 13 miles northwest of Carson, Washington, at the confluence of the Wind River and Tyee Springs (River Mile 18), at 1,180 feet above sea level. Carson NFH began operation in 1938 by rearing and releasing fall Chinook salmon and trout.

In 1956, the hatchery was remodeled under the Mitchell Act. Construction of a fish ladder at Shipperd Falls (River Mile 2.1) in 1955 made it possible for spring Chinook to pass upstream to the hatchery. Trapping of spring Chinook at Bonneville Dam began in 1955, after Washington shore trapping facilities were completed, and continued through 1961. Those trapped fish were used to establish the Carson run of spring Chinook in the Wind River. Other species such as steelhead, brook trout, rainbow trout, kokanee, and coho have also been raised at Carson. Coho were raised as late as 1981. Current production involves adult collection, egg incubation and rearing of spring Chinook salmon.

Please note that sport and tribal harvest based on recovery of coded wire tags in the Columbia River as well as the tributaries (for example Wind River) are all reported as Columbia River harvest.

Brood year 1982 to 1985 spring Chinook from Carson were marked with coded-wire tags for a density study. The average total survival of these brood years is 0.22%. The majority of off station recoveries were in the freshwater sport fishery. There were an estimated 20 recoveries of brood year 1982 and 1983 fish in Canadian waters. An estimated 43 recoveries of brood year 1985 fish occurred in ocean fisheries in Alaska, Canada, and Washington.

Because of a WDFW fish marking study at Carson, WDFW sampled returning adults and originally reported recoveries for return years 1993 through 1996. During the change over from format 3.2 to 4.0, USFWS reported these recoveries.

The survival rate for Carson brood year 1988 is 0.4044% using the rd2 program which expands each coded-wire tag, rather than using a PEF, and including one additional expanded freshwater sport recovery reported by WDFW. The majority of contribution to fisheries was in the Columbia River freshwater sport, expanded to 5,339. Recoveries in the treaty ceremonial fisheries were expanded to a catch of 1,023.

Brood year 1989 was also part of the fish marking study conducted by WDFW. The estimated survival for this brood year is 0.1368%, less than a third of the previous brood year. The majority of fish taken off station (2,095) were taken in the freshwater sport fishery reported by WDFW. Two observed recoveries in the Washington ocean troll fishery were expanded to a total of 12 fish caught.

The survival rate for brood year 1990 is 0.0778%, a total of 1,801 fish from a release of over 2 million. A third of the fish entering the Columbia River were harvested before reaching Carson. Most of these recoveries, estimated at 125, were freshwater sport reported by WDFW. Treaty ceremonial fishery recoveries reported by ODFW show 32 fish taken, followed by 27 in the Columbia River sport fishery.

Brood year 1991 survival is now estimated to be 0.0239%. This is less than brood year 1990 and the lowest to date. The largest off station take of fish was the ODFW reported treaty ceremonial harvest of 69 fish. Four fish were recovered in WDFW spawning ground surveys, expanded to 12. This was the last brood year for the WDFW mark study.

Survival for brood year 1992 is 0.6145%, the highest since brood year 1988. An estimated 82 fish were harvested in the California ocean troll fishery, an unusual event. Since all of the coded-wire tags released with brood year 1992 were used for a density study, none of the tag codes represents the majority

of fish released. Recoveries for this brood year at Carson NFH were originally reported by WDFW.

The 1993 brood year now has the fifth highest survival for this hatchery at 0.4371%. An estimated 42 fish were harvested in the California ocean troll fishery as jacks. The harvest of these fish off of California occurred the same year as the harvest of 82 fish from brood year 1992. WDFW freshwater sport fishery recoveries are expanded to a harvest of 4,494 fish, nearly as many as returned to the hatchery. Since all of the coded-wire tags released with brood year 1993 were used for a new density study, none of the tag codes represents the majority of the fish released.

Brood year 1994 survival is now estimated at 0.1243%. There are an expanded 882 fresh water sport recoveries, 1,082 expanded returns to hatcheries, and 165 expanded spawning ground recoveries. This equals a total of 2,141 expanded recoveries for the 1994 brood year.

There are an additional 4 PSC expanded WDFW freshwater sport recoveries this year, increasing the estimated survival for brood year 1995 to 0.3770%, in the upper third of successful brood years for Carson NFH. There have been an estimated 997 expanded off station recoveries from these fish, all in the Columbia Basin.

The estimated survival for brood year 1996 is 1.1039% with an estimated 9,097 off station recoveries, and 10,047 returns to the hatchery. This brood year is one of the most successful yet for Carson NFH. Over seventy-five hundred fish were harvested in the WDFW reported freshwater sport fishery. The second greatest harvest was for treaty ceremonial (859).

Brood year 1997 has one of the highest survival rates yet for Carson NFH spring Chinook at 1.2826%. Over ten thousand fish were harvested in the Columbia River, including eighty two hundred in sport fisheries, and 1,353 in the Columbia River gill net fishery, and 259 for treaty ceremonial. Fourteen fish were also harvested in British Columbia.

Brood year 1998 total survival is estimated to be 1.3635%. Over thirteen hundred fish were harvested in the Columbia River Basin. The majority of the harvest was sport - over ten thousand - followed by a gill net harvest of 1,960.

The estimated survival for brood year 1999 is 1.446%, which is nearly equal to that of the 1998 brood year. Nearly thirteen thousand four hundred fish were harvested in the Columbia River with a sport harvest of 9,450.

With additional Age5 FWS and WDFW recoveries brood year 2000 Carson fish have an overall survival of 0.6967%. This brood year contributed seven thousand one hundred twenty-two to Columbia River fisheries: 1,200 in the gill net fishery, nearly six thousand to fisheries within the Columbia Basin. An additional 26 fish were taken in both the Treaty Ceremonial, and Ocean Troll fishery in Canada. Coded-wire tag recoveries expand to a return of 2,949 fish to Carson NFH, close to the Age Composition derived estimate of 3,044.

An additional Age4 fish, and half a dozen recoveries of Age 5 fish makes survival for brood year 2001 about 1/3 of that of the previous brood year at 0.2551%. Approximately two thirds of this return was harvested within the Columbia Basin, mostly as sport catch. Gill nets took an estimated 483 fish, and 31 fish were caught in treaty fisheries.

Brood year 2002 has an estimated total survival rate of 0.3448%, below the average to date of 0.4602%, but higher than that of the previous brood year. About twenty-one hundred fish were harvested in combined freshwater sport

fisheries.

## **Dworshak National Fish Hatchery**

Dworshak NFH is located at the confluence of the North Fork Clearwater River and the main stem Clearwater River about three miles west of Orofino, Idaho, at 1,000 feet above sea level. Dworshak NFH first began operations in 1969 rearing summer steelhead and resident trout to mitigate for fish lost by the construction and operation of Dworshak Dam. The facility was expanded in 1982 under the Lower Snake River Compensation Program (LSRCP) to rear spring Chinook salmon. The hatchery is now used to produce spring Chinook and summer steelhead.

### **Spring Chinook**

Total recoveries for **brood year 1985** were 0.0201%, the first release of 100% Rapid River stock. The brood year 1986 yearling release resulted in an estimated 2,595 fish, or 0.2306%.

Twelve different coded-wire tag groups were released with **brood year 1987**. Only three were in yearling fish released at the hatchery. Coded-wire tag release information was obtained from the StreamNet Distributed System. Total survival is estimated at 0.0041%. The ODFW reported freshwater sport harvest took an estimated 13 fish.

Overall survival for **brood year 1988** is now 0.0605%. This brood year contributed mainly to the treaty ceremonial fishery in the Columbia River.

Yearlings from **brood year 1989** survived only half as well as brood year 1988. A total of 70 fish were harvested in the Columbia basin, and 3 were recovered at WDFW hatcheries. Fifty-two fish were taken in the treaty ceremonial fishery. Overall survival is 0.0353%.

Coded-wire tag information for **brood year 1990** was obtained from the StreamNet Distributed System. Total estimated survival for this brood year was 0.0027%, or 26 fish from a release of almost 960,000. The treaty ceremonial fishery reported by ODFW took two fish from this brood year.

**Brood year 1991** has an estimated overall survival rate of 0.0021%, the lowest of tagged brood years in this report. There was only one off station recovery from this brood year.

All **brood year 1992** spring Chinook released at Dworshak were represented by coded-wire tags, so the rd2 program was used to estimate the total survival of 0.0584%. An estimated 78 fish, or 10% of the total, were recovered at a variety of Columbia River Basin sites other than Dworshak.

Numerous recoveries of **brood year 1993** fish by FWS were added to the RMIS database in the year 2007. Location recovered is Dworshak NFH and Kooskia NFH. Total survival is now estimated to be 0.2675%, or 3,508 fish. The rd program was used since fish unrepresented by coded-wire tags were released. There were an estimated 721 recoveries off station, including 4 in Alaska and 4 in British Columbia ocean fisheries with an estimated 2,779 fish returning to the hatchery. This brood year also provided an estimated 177 fish for treaty fisheries.

Numerous recoveries of **brood year 1994** fish by FWS were added to the RMIS database in the year 2007. Location recovered is Dworshak NFH and Kooskia NFH. Although this more than doubles total estimated survival, it still stands at 0.0807%, less than half of the average to date as of 2008. Because of a very low adult return, there was also a low egg take, and a



subsequent release of just 100,775 fish for brood year 1994. A mere 83 fish were recovered. The largest number of off station recoveries was in the IDFG reported freshwater sport category, but was only 14 fish. There were also 3 expanded recoveries in the Alaska ocean troll fishery. There was also 1 FWS reported recovery at Warm Springs NFH.

The addition of numerous recoveries of **brood year 1995** fish by FWS were added to the RMIS database in the year 2007, and the removal of an earlier, now found to be erroneous group of fresh water Fish Trap recoveries results in an estimated survival of 0.1696% for brood year 1995. Because the 1995 return to Dworshak was a total of 125 fish, only 53,078 yearlings were released. Only an estimated 90 fish were recovered from this brood year, eighty-six of them at hatcheries.

The estimation of survival for **brood year 1996** is 0.0979%. Columbia River sport (429), treaty ceremonial (228) and gill net (147) fisheries took more fish than are currently in the RMIS database for recoveries at FWS hatcheries.

**Brood year 1997** has an estimated survival of 0.5363% even with only 5 estimated recoveries of coded-wire tagged fish at National Fish Hatcheries, a record. The contribution to freshwater fisheries was over fifty-five hundred fish. Fish from this brood year (29) were even caught by ocean trollers as reported by ODFW.

**Brood year 1998** has the highest survival rate to date at 0.8582%, and a total of 8,711 fish. Columbia River sport and gill net fisheries took over forty-seven hundred fish in 2004 and 2005. Fish (24) were also caught by Alaskan ocean troll fishers.

With the addition of FWS hatchery recoveries from 2004, **brood year 1999** survival is higher than average at 0.1093%. Gill net and sport recoveries in the Columbia River Basin account for all off station recoveries. Twenty-two of those expanded recoveries were reported by Idaho.

Survival increases substantially for **brood year 2000** at 0.5203% with the addition of FWS hatchery recoveries from Dworshak NFH. This survival is now the third highest on record for Dworshak spring Chinook. Columbia River contribution from this brood year nearly equaled the return to the hatchery (2,313 / 2,846). One observed ocean troll recovery by CDFO is expanded to a total of 47 fish.

Now in sixth place when ranked by survival is **brood year 2002** with a preliminary estimate of 0.1855% and a Columbia River contribution of 791.

### **Summer Steelhead**

Total survivals for brood years 1980, 1981, and 1982 were 2.9305%, 1.2033%, and 0.3813% respectively. Although the Stock Assessment printout shows 0 Escapement to NFH, this results from the fact that Idaho Department of Fish and Game (IDFG) reported hatchery recoveries at Dworshak NFH in the early 1980s.

Tagged fish from brood year 1983 (release year 1984 with CWTs 051335, 102516, and 102517) are listed as "Off-site direct hatchery release" in the StreamNet database.

No coded-wire tagged fish were released on site in brood year 1983 or 1984.

Survival for brood year 1985 has stabilized at 1.1867%. Over 5,400 fish were

taken in the Columbia River gill net fishery, and over 4,100 were taken in the freshwater sport fishery reported by Idaho.

Brood year 1986 has an overall recovery rate of 1.9046%. This brood year contributed mainly to the freshwater sport fishery in Idaho. Many of these steelhead were also recovered in the Columbia River gill net fishery.

Total survival rate for brood year 1987 is 1.0603%. Six fish were taken in British Columbia ocean trolling, but the great majority of fish (8,324) were recovered in the Columbia River basin. The majority of "Columbia River" harvest was in the ODFW reported gill net fishery (4,124), and the IDFG reported freshwater sport fishery (3,816).

Brood year 1988 summer steelhead yielded 492 observed recoveries with an overall estimated survival rate of 0.5579%. The vast majority of fish recovered off station were taken in the Columbia River gill net fishery (2,696), followed by the Columbia River sport fishery (576). IDFG reported freshwater sport recoveries expanded to 184 fish. There was 1 observed recovery of an age-2 fish in the squid gill net by-catch and foreign research vessel records reported by National Marine Fisheries Service (NMFS)

Overall survival for brood year 1989 is 0.8264%. Most fish were taken in the Columbia River gill net fishery (3,714) out of a total of 4,907 fish taken in the various Columbia freshwater and estuary fisheries. Sixty-three fish were taken off the coast of British Columbia. IDFG recoveries are expanded to 244.

Brood year 1990 release data were obtained from the StreamNet database. Except for one different date, 90 additional fish, and a significant difference in the total weight of fish released, StreamNet records are similar to those originally reported for releases at the hatchery. The total survival rate is 0.4821% or 5,750 fish. Most of the harvested fish were taken in the Columbia River gill net fishery (2,575). Twenty-five fish were also taken in the Oregon ocean sport fishery.

Total survival for brood 1991 is 0.2388%, near the bottom of survival rates for Dworshak steelhead. A total of 2,923 fish survived from this brood year. Seventy-five fish were harvested in the Quinault reported coastal gill net fishery. ODFW reports Columbia River gill net and sport harvest of 984 and 149 fish, and another 328 fish as freshwater sport.

Survival for brood year 1992 is now estimated to be 0.2259%, using the rd2 program. Twenty-nine percent of the fish were recovered before returning to the hatchery. Off station recoveries occurred in the Columbia River gill net and freshwater sport fisheries of all three Northwestern states, with Washington reporting the largest share.

The current estimated survival for brood year 1993 is 0.218%, the third lowest to date. All reported off station recoveries were within the Columbia River basin, and 643 fish were harvested there, mostly in sport fisheries.

Observed recoveries for brood year 1994 are expanded to a total of 1,065 estimated recoveries or 0.0878% by the rd2 program. More fish were recovered off station (769) than returned to the hatchery, according to coded-wire tag recoveries.

Survival for brood year 1995 is about half that of the previous brood year, or 0.0441%.

Numerous recoveries of brood year 1996 fish by FWS were added to the RMIS database in the year 2007. Location recovered is Dworshak NFH and Kooskia NFH. This brood year now has a total estimated survival of 0.1732% with 1,320 fish

returning to the hatchery. While IDFG reported the equivalent of 4 fresh water sport recoveries, WDFW had 752, gill nets had 174, and another 107 were caught in other Columbia River fisheries.

When this report was prepared last year there were no age 5 recoveries in RMIS, and, more importantly, there were no reported recoveries at any hatchery of any age, including Dworshak. Age 3, 4, and 5 recoveries are now in database, and allow a more accurate estimation of total survival for brood year 1997, a total of 4,325 fish. WDFW reported fresh water sport fisheries recoveries are equivalent to 772 fish. Next in magnitude is the Columbia River gill net fishery with 438, all at age 3. Recoveries in other within basin sport fisheries equaled 268.

Due to continuing irreconcilable differences between original and RMIS reporting, original CRiS records for all subsequent brood years will be stored in the CRiS data file srDwor, and replaced with records from RMIS.

FWS recoveries for brood year 1998 at Dworshak are in now in RMIS giving an above average survival of 0.8582%. Columbia River gill net (2,282) and sport fisheries (2,440) harvested the great majority of fish from this brood year. Alaska ocean trollers also took 24 fish.

Survival for brood year 1999 is 0.1009%, equal to 336 fish out of 125,452 released. Approximately one third of recoveries were in sport fisheries in the basin and the gill net fishery.

With 366 observed recoveries the estimated survival of brood year 2000 is 0.2762%. With slightly more than half of the fish recovered at the hatchery, the Columbia River contribution included 773 in the gill net fishery, with the remainder taken in sport fishers in Idaho, Oregon and Washington.

The survival of brood year 2001 can be described as poor at 0.1765%, with only 3 other brood years being lower out of a total 21. Off station recoveries were mostly IDFG sport and Columbia River gill net, with a few score reported by ODFW.

## **Eagle Creek National Fish Hatchery**

Eagle Creek National Fish Hatchery is located about seven miles from Estacada, Oregon, on Eagle Creek, approximately ten miles above its confluence with the Clackamas River at an elevation of 950 feet. The hatchery was authorized by the Mitchell Act of 1938 (52 Stat. 345), as amended in 1946.<sup>i</sup> The hatchery was constructed in 1956, and is currently operated as part of the Columbia River Fishery Development Program administered by NOAA - Fisheries. Two ladders enable fish to ascend Eagle Creek. The lower or Dywer Falls, 6 feet high and 5 miles above the mouth, was ladderized by USFWS in 1958. An inadequate ladder on the 10 foot high middle falls, 9 miles above the mouth, was replaced with a new ladder in 1956.<sup>ii</sup>

Although Eagle Creek NFH has raised fall and spring Chinook in past years, production is now limited to coho and winter steelhead. Steelhead are no longer being coded-wire tagged to assess contribution because of the low rate of recovery sampling in Eagle Creek and the Clackamas and Willamette Rivers; however, coded-wire tagging of steelhead occurred recently for brood years 2004-2006 as part of a USFWS rearing density study.

### **Coho**

Coded-wire tags were used in a multiple year density study including brood years 1979, 1980 and 1981. Brood year 1980 survival rate was 1.3546%, and brood year 1981 survival was 1.0413%. Oregon ocean fisheries took nearly four times more fish than Washington ocean fisheries in brood year 1980. Brood year 1981 had an almost even split between the two fisheries.

No coded-wire tags were released in brood years 1982 through 1987.

The estimated total recovery from brood year 1988 was 42,345 fish, or 4.181% when using a PEF. Nearly three hundred thousand of the coho released were from the Sandy Hatchery, and these fish did not have a unique coded-wire tag. This is highest survival rate on record for Eagle Creek coho. This brood year contributed 11,340 fish to the Oregon ocean fisheries, and 8,930 were harvested in the Columbia River fisheries.

The 1989 brood year coho survival rate was 0.9446%, about one quarter of the very high 4.181% survival rate of brood year 1988 coho. Over 3,800 of the coho from this brood year were caught off the Oregon coast in the sport and commercial fisheries. Eighteen hundred were harvested in the ocean off Washington, and 200 off California. Over 200 fish were taken in British Columbia. Eight hundred twenty were also harvested in the Columbia River.

Brood year 1990 coho has only 31 observed recoveries and an overall survival rate of 0.1228% making this the lowest survival rate since coded-wire tagging has been done consistently. Fish from Big Creek and Sandy were released along with Eagle Creek fish this year. Fewer than 600 fish were taken in the ocean, and 310 in the Columbia River. Five hundred of the ocean recoveries were reported by WDFW. The remaining 96 were split evenly between Oregon and California. Coded-wire tagged returns to the hatchery were estimated to be less than the ocean harvest of this brood year.

Total survival rate for brood year 1991 coho is estimated to be 0.3402%. Fish from the ODFW Sandy hatchery were released this year, so even though all fish were assigned to a coded-wire tag, they are not truly representative. Only 137 fish were harvested in the ocean (91 by British Columbia and 46 by Washington), and 205 in the Columbia River. Escapement to the hatchery was about 3,300 fish. Although this brood year did better than the 1990 fish, it was much less successful than 1980, 1981, 1988 or 1989.

Brood year 1992 survival rate is estimated at 0.4758%, an improvement over the previous two broods, but still below average for broods in the 1980s. Escapement to the hatchery made up the largest segment of fish recovered, as was also the case for brood year 1991. Washington ocean fisheries took 750 fish and Oregon ocean fisheries harvested 277 fish. An additional 197 fish were taken in the Columbia River.

Brood year 1993 releases included both forced and volitional releases of Eagle Creek stock and Toutle stock coho. Expansion of individual coded-wire tags rather than using a PEF yields a total survival of 0.2375%, placing this brood year in the lower third of survival rates. There were an estimated 121 recoveries in the Columbia River, and 358 in the ocean off of British Columbia and Washington.

Total survival for brood year 1994 was even lower at 0.1758%. WDFW reported ocean recoveries result in an ocean harvest of 263 fish, with 66 fish harvested in the Columbia River estuary sport fishery.

Brood year 1995 was the first brood year at Eagle Creek in which coho production was "mass marked" with an adipose fin clip. A small number of fish were not adipose fin clipped, but received a coded-wire tag. Since externally marked fish may be harvested at a different rate than the unmarked fish, recoveries have been expanded for each coded-wire tag, rather than with a PEF. WDFW Columbia River estuary sport now has an additional 4 expanded recoveries. Survival is now estimated to be 2.1002%, in the upper third of brood years.

A doubling of ODFW reported Columbia River gill net fishery recoveries increases total survival for Eagle Creek brood year 1996 coho to 1.7191%, putting this brood year in the upper half when ranked by survival. Two thousand five hundred forty-nine fish were harvested in the ocean and 1,586 in the Columbia River.

A recalculated expansion for recoveries at the hatchery, plus other changes in reporting results in an estimated survival of 3.9776% for Eagle Creek brood year 1997 coho. Only brood years 1998 and 1988 are higher. Over fifty-two hundred fish were harvested in the ocean, almost equally divided between Oregon and Washington with an additional 95 recoveries estimated for California ocean sport fisheries.

An adjustment to the expansion rate of NFH recovered tags increases the estimate of survival for brood year 1998 to a record 4.9126%. This new hatchery return rate is closer to the rate determined with the Age Composition Analysis of the two return years. Over eighty-five hundred fish were taken in WDFW ocean fisheries, and over fourteen hundred in ODFW reported ocean fisheries. This gives a total of 9,965 fish harvested in the ocean. Additionally, ODFW had reported that an additional eighty-five hundred fish were taken in the Columbia River.

The survival rate for brood year 1999 is a very respectable 1.9272%. Ocean recoveries (883) were almost evenly split between Oregon and Washington, but most of the harvest occurred in the Columbia River (1,380). Expansion of CWT recoveries shows a return to the hatchery of 11,457 fish.

There were 511 observed recoveries of coded-wire tags from brood year 2000, which when expanded give a total survival rate of 1.5508%, a small reduction since last year. This is about average for Eagle Creek NFH coho. Most off hatchery recoveries were in the Columbia River gill net and estuary (472). Ocean fishery reports account for 524 expanded recoveries: 301 in Oregon, and 223 in Washington. Over seven thousand fish returned to the hatchery.

Eagle Creek had been releasing around one million coho per year since at least

the early 1980s. Because of limited harvest opportunities, however, the production goal was reduced to 500,000. The 2000 brood year was the first year this new goal was implemented.

Brood year 2001 survival is estimated to be 1.2103, which is about average. Ocean harvest was split 374 to 256 for Washington and Oregon respectively.

An estimated survival of 1.5391% means that brood year 2002 was slightly below average. This brood year contributed nearly 600 fish to ocean fisheries, and about five hundred to Columbia River harvest. Meanwhile the expanded recoveries at Eagle Creek were 7,480, while actual counts at the hatchery give a return of ninety-five hundred.

Survival for brood year 2003 is close to that of 2000 at 0.1662%. Nine hundred seventy-two fish were caught in the ocean, while 610 were taken in the estuary and fresh water.

## **Entiat National Fish Hatchery**

Entiat NFH is located on the Entiat River, west of Entiat, Washington. Elevation is 980 feet above sea level. Construction began in 1940 under the Grand Coulee Fish Maintenance Project and operations began a year later. Present production at the hatchery consists of adult collection, egg incubation, and rearing of spring Chinook salmon. As of 2005 Entiat NFH is in the fourth year of spawning and incubating Coho eggs for the Yakama Nation.

Yearling spring Chinook at Entiat were coded-wire tagged beginning with brood year 1988. Expanded off station recoveries include 57 in the treaty ceremonial fishery and 6 in the Columbia River sport fishery. Expanding CWT recoveries for brood year 1988 gave an estimated survival of 0.1023%, about average for this hatchery and species. Eggs from Winthrop NFH were raised and released at Entiat as part of this brood year.

There were 56 observed recoveries of the 111,207 tagged fish released with brood year 1989. Expansion of these recoveries yields an overall survival rate of 0.0519%. Seven fish were taken in the Columbia River sport fishery. Production for this brood year included fish raised from eggs transferred from Leavenworth NFH.

There were only four observed recoveries from the 95,682 tagged fish released with brood year 1990. Using the rd2 program yields an estimated total survival of 0.0047% for this brood year, the worst survival on record for Entiat spring Chinook. All recoveries were at the hatchery.

Brood year 1991 was a bit more successful than the previous brood year with a total survival rate of 0.0279%, using the rd2 program. Nine fish were taken in the Columbia River treaty ceremonial fishery. All observed (28) recoveries were of age-4 fish.

A total recovery rate of 0.0346% puts brood year 1992 third from last when ranked by survival rate for yearling releases at Entiat. The freshwater fish trap category accounts for most of the off station recoveries, although there were also a few treaty ceremonial and WDFW hatchery recoveries.

Total survival for brood year 1993 was 0.0383%, better than the previous two brood years, but still ranking as fourth worst. Five coded-wire tagged fish were recovered in fish traps. While most returned to the Entiat, an estimated 19 total fish were recovered at WDFW hatcheries.

The yearling release for brood year 1994 included fish received as eggs from Leavenworth NFH. Total survival was estimated to be 0.0667% with an estimated 10 non-hatchery recoveries. This survival rate is in the middle of Entiat yearling spring Chinook survivals.

The estimated total survival for brood year 1995 is 0.3282%. There were 3 ODFW reported ocean troll recoveries and 8 recoveries in the Columbia Basin. WDFW hatchery recoveries were at Wells. Brood year 1995 is in the top fourth of survivals

Brood year 1996 has provided a high estimated survival for Entiat NFH spring Chinook, now at 0.5855%. This was in spite of the use of a blank coded-wire tag for 16,053 of 124,536 yearling fish released. This blank wire could yield no off station recoveries. There were three expanded ocean recoveries, this time reported by British Columbia. Treaty ceremonial and sport recoveries were the next two highest off station recovery categories with an estimated 54 and 36 recoveries respectively. As usual the lion's share of recoveries (91%) was at Entiat NFH.

Entiat brood year 1997 currently has yielded an estimated total survival of 0.7732%, the highest to date for Entiat. Off station recoveries were mostly in the ODFW reported Columbia River sport (211) and gill net (211) fisheries. There were also an estimated 11 treaty ceremonial recoveries.

The third highest number of recoveries now comes from brood year 1998: an estimated 2,067 recoveries and a survival rate of 0.5747%. Most non station recoveries were in the ODFW reported Columbia River gill net fishery (357), followed by the Columbia River sport fishery (94).

Brood year 1998's survival of 0.5747% puts it in third place for overall survival of Entiat brood years. Four hundred ninety-three fish were harvested in the Columbia River with 357 in the gill net fishery and 94 in sport fisheries.

Survival falls to less than one fifth of the previous year for brood year 1999 at 0.089%. An estimated 33 fish were recovered off station: 11 in spawning ground surveys, 13 in the Columbia River gill nets, and 19 in sport fisheries.

Although survival for brood year 2000 rises to 0.1591, it is still below the average of 0.17%. Gill net and sport fisheries were responsible for recovery of 95 fish: 55 and 40 respectively. An estimated 12 fish were found in spawning ground surveys.

Fish from brood year 2001 had a survival of 0.2206%, which is above average. One hundred nine fish were taken in Columbia Basin sport fisheries, and another 54 in gill nets; while CWT recoveries at Entiat expand to an estimated 699 fish.

Estimated survival for brood year 2002 is half that of the previous brood year, 0.1104%, although new recoveries frequently show up in RMIS for the most recent brood years included in this report. Total number recovered from this brood year is estimated at 427 fish.



## **Kooskia National Fish Hatchery**

Kooskia NFH is situated along Clear Creek, just upstream of the confluence with the Middle Fork Clearwater River, approximately 75 miles southeast of Lewiston, Idaho, at an altitude of 1,295 feet. The hatchery was authorized in 1961, first operated in 1969, and is currently used for adult collection and rearing of spring Chinook salmon.

Only two broods during the 1980s received tag codes at Kooskia. An age-0 release of brood year 1980 fish contained an IDFG tag code. Fish raised at Kooskia were released at Dworshak NFH with an IDFG tag code. Fish from Hagerman NFH were released at Kooskia in 1983.

Brood year 1988 fish at Kooskia were the first fish to be marked under the Missing Production Group program. Total survival for brood year 1988 was 1,083 fish, or 0.2683%. Treaty ceremonial fishing took most of the fish harvested off station (156). Nineteen fish were also taken in the ODFW test fishery net.

No tagged fish were released with brood year 1989.

An estimated 77 fish were recovered from brood year 1990, resulting in a survival rate of 0.0106%. Eleven of those fish were taken in the Columbia River sport fishery in 1994.

Total fish released for Kooskia NFH brood year 1991 was 343,437, including coded-wire tag 052925 with 60,585 fish. Current RMIS records show 50,585 fish released with this tag code, making a total release of 333,437. Total recoveries for this brood year consist of a jack and an adult recovered at a national fish hatchery for a survival of 0.0006%.

Fish traps and non-USFWS hatcheries reported the majority of off station recoveries for brood year 1992. An estimated 4 fish were taken in the treaty ceremonial fishery. With 86 recoveries reported by USFWS, total estimated survival rate is 0.0317% using the rd2 program, better than the previous two brood years.

Survival for brood year 1993 is estimated to be 0.0327%, right in the middle of survivals. Nine fish were taken in the California ocean sport fishery, an unusual occurrence. Thirty-two fish were harvested in the treaty ceremonial fishery. Fish without coded-wire tags, but with right ventral fin clips, were also released eight miles above the hatchery. There were an unusual number of recoveries of spring Chinook in California ocean sport and troll fisheries in 1996. Spring Chinook from Carson, Little White, and Warm Springs were also taken, as were tule fall Chinook from Spring Creek.

There were 8 observed recoveries from the release of 271,681 tagged fish in brood year 1994. The estimated number of recoveries in the ODFW fish trap is 521 from one observed recovery, a very high ratio. No recoveries have been reported from FWS hatcheries. A group of fish was released without a representative coded-wire tag. The PEF for this brood year is 1.23, and leads to a total survival of 0.0027%.

Fewer than 16,500 tagged fish were released in brood year 1995 in a total of 16,598 fish. There is now 1 reported recovery by an IDFG hatchery for a survival of 0.0060%.

With 15 observed recoveries, brood year 1996 total survival is estimated to be 0.0649%, or 28 fish. Ten fish were harvested in the gill net fishery, 8 for treaty ceremonial purposes, and 7 in Columbia River sport fisheries.

Brood year 1997 coded-wire tag release information was obtained from the RMIS database. It is substantially different than numbers reported through CRiS, as noted on the Stock Assessment Reference Summary. Previous numbers will be replaced with the numbers in RMIS next year.

The survival rates for coded-wire tags in this release are expanded to a record 0.8767% survival for Kooskia NFH, without any FWS reported recoveries. Contributions were made in the following fisheries: Columbia River gill net and sport (1,000 and 865), freshwater sport (109), treaty ceremonial (66). There were 4 PSC expanded recoveries in the Oregon reported non-treaty ocean troll in 2001.

Release numbers in RMIS differ from those reported to CRiS for brood year 1998. Numbers in CRiS have been edited to conform to numbers reported to RMIS. Brood year 1998 has the third highest survival rate for Kooskia NFH spring Chinook at 0.76632% now that FWS recoveries are in RMIS. These FWS recoveries expand to a hatchery return of 852 fish, with a Columbia River contribution of 1,946. Nine hundred of those recoveries were by Columbia River gill net, and sport fisheries took 917 fish. Spawning ground survey information shows an estimated 67 fish at Kooskia NFH from this brood year.

RMIS records for brood year 1999 total 82,974 fish vs 80,430 previously recorded in the CRiS database. With the additional of 14 observed recoveries by FWS, estimated survival for this brood year is 0.1410%. Columbia River gill nets took the largest number of fish at 22, and with the estimated take in the sport fishery at fourteen fish. There were a total of 5 expanded recoveries in spawning ground surveys.

Brood year 2000 RMIS release records for CWT 054516 appear to include fish released off station, but in Clear Creek (CRiS sr80s Dist-KK). Age4 and Age5 recoveries by FWS have come on line since the last report, and the current survival for this brood year is 0.3068%. Columbia River sport fisheries reported the highest number of recoveries for this brood year, estimated at a total of 432 fish, followed by gill net (359), then other freshwater sport with 135.

Survival for brood year 2001 is about a fifth that for the previous return at 0.0536%, a total of 294 fish. Using the CWT recoveries, an estimated 194 fish returned to the hatchery. Although Columbia River contribution is only 89 fish, 11 were also taken in ocean troll fisheries reported by Oregon.

## **Leavenworth National Fish Hatchery**

Leavenworth NFH is located about four miles south of Leavenworth, Washington, along Icicle Creek, a tributary to the Wenatchee River. Elevation is 1,155 feet. The hatchery was originally authorized in 1937 by the Grand Coulee Fish Maintenance Project and was re-authorized in 1938 by the Mitchell Act. The facility began operations in 1942 and is currently used for producing spring Chinook salmon.

Fish from brood year 1985 were released at Leavenworth with two different tag codes. Fish with those same tag codes were also inadvertently released in the Yakima River, and are therefore not included in this report.

Fish from brood year 1986 were harvested mainly in the freshwater sport (757) and treaty ceremonial fisheries (402). One recovery from the ODFW treaty ceremonial fishery is no longer in the PSMFC database. Total estimated survival is estimated at 0.1174%.

Brood year 1987 spring Chinook salmon released as yearlings have an estimated total survival of 0.2785%. Off station recoveries were mainly in the freshwater sport fishery and treaty ceremonial fishery. Nearly 3,000 fish were taken in the Columbia River. One tag, which was expanded to 28 fish, was recovered in the British Columbia ocean troll fishery. The 1987 brood year spring Chinook released as sub-yearlings fingerlings survived at a rate of only 0.0030%. This release of 939,426 fish yielded a freshwater sport catch of 12 fish, and a hatchery escapement of 16 fish.

Brood year 1988 spring Chinook fared quite a bit better than brood year 1987 with an estimated survival rate of 0.4751%. Most fish were taken in the freshwater sport fishery (3,469). In addition, ODFW reported a treaty ceremonial harvest of 1,315. Twenty-five fish were harvested in the WDFW reported treaty troll fishery. Fingerling releases from this brood year survived at an overall rate of only 0.0034%. There were only seven observed recoveries from a release of nearly 300,000 tagged fish.

An agency 63 tag code was released with brood year 1989 age-0 Leavenworth fish raised at Wells State Fish Hatchery (SFH) and returned to Leavenworth for further rearing. These fish survived at a rate of 0.0889%. Using the calculated PEF of 4.41, 13 fish were harvested in the British Columbia ocean troll fishery, 163 in the freshwater sport fishery, and 66 in the treaty ceremonial fishery. However, this PEF includes 400,000 fish released at one-third the size of the fish with the coded-wire tags.

Yearling fish from brood year 1989 survived at a rate of 0.1946%, more than twice the rate for fish released at age-0. The great majority of off station recoveries occurred in the Columbia River sport fishery (1,585). An additional 360 fish were taken in the treaty ceremonial fishery.

Using the rd2 program, rather than the PEF method, the estimated number of fish surviving from brood year 1990 yearlings was only 78 fish from a total release of over 2 million fish, a very low survival rate of 0.0034%. Treaty ceremonial harvest of this brood year is estimated to have been only 23 fish. Age-0 fish released from this brood year had no representative coded-wire tag.

Survival of brood year 1991 is now estimated at 0.0213%, a total of 374 fish, using the rd2 program. This survival is over six times greater than brood year 1990. Fourteen age-4 fish were taken in the ODFW reported treaty ceremonial fishery. Age-0 fish released from this brood year had no representative coded-wire tag. Observed recoveries include age-2 fish recovered at the hatchery, 89. There are fewer PSC expanded recoveries, 82, which does not include these fish.

Survival was up again with a 0.0754% rate for brood year 1992 using the rd2 program. Other than 987 hatchery recoveries, there were 124 fresh water sport recoveries, in addition to treaty ceremonial (32) and Columbia River gill net harvest (5).

Brood year 1993 survival is now at 0.2748% using the rd2 program, still increasing from the low point of brood year 1990. Only the last three brood years in the 80s had higher survivals. There was a freshwater sport harvest of 1,067, followed by treaty ceremonial (61), and freshwater net (60).

The estimated survival for brood year 1994 is 0.0580%. An estimated 34 fish were recovered in treaty ceremonial fisheries, and 50 in freshwater sport fisheries.

Survival for brood year 1995 is estimated to be 0.1232% with over three hundred fish being harvested off station. Fish were taken in gill net, fresh water sport, and treaty ceremonial fisheries.

Estimated survival for brood year 1996 is 0.3747% in the upper third of survivals. There were 2 recoveries in Alaska, expanded to a total estimated 26. There were also a total of 388 estimated recoveries in the WDFW reported fresh water sport recoveries, and over two hundred each in gill net, spawning ground, and treaty ceremonial fisheries.

Brood year 1997 shows an estimated total survival of 0.7675%, a record setting brood year. The greatest number of fish recovered off station was in the Columbia River sport fishery (2,140). The gill net fishery took an estimated 2,100 fish, followed by recoveries in spawning ground surveys (750), and treaty ceremonial (127).

Slightly lower than the previous brood year at 0.7190%, but still the second highest on file, brood year 1998 contributed about thirty-seven hundred fish to Columbia River fisheries. Thirty-nine fish were harvested in the ocean. A downward adjustment of a CDFO expansion factor reduced this survival in 2006.

Estimated survival for brood year 1999 is 0.0961%, and increase over last year due to the addition of 3 observed recoveries by WDFW. This is in the lower third of recorded survivals. Gill net and sport recoveries totaled 666 fish, and there were and estimated 87 recoveries in spawning ground surveys.

Additional recoveries from Leavenworth brood year 2000 have appeared in data down loaded from RMIS. Therefore, the total number of fish that were caught or returned to the hatchery is 5,799, equivalent to a survival of 0.3731%. Nearly twenty-five hundred fish were taken in the Columbia Basin, in both sport and gill net fisheries. WDFW spawning ground surveys reported an estimated 292 fish. Alaska accounts for 2 observed troll recoveries, equivalent to 5 total fish.

The estimate of survival for brood year 2001 is 0.2655%. Columbia River contribution is estimated at 790 fish. Most of those fish were taken in the ODFW reported "River sport" fishery. The gill net fishery harvested an estimated 161 fish.

Completed brood years to date have an average percent survival of 0.25%, and the preliminary estimation for brood year 2002 is 0.0959%, about a third of that average.

Summer steelhead at Leavenworth have never been marked with coded-wire tags.

## **Little White Salmon National Fish Hatchery**

Little White Salmon NFH is located on the Little White Salmon River, 12 miles east of Stevenson, Washington, at an elevation of 90 feet. The hatchery began operations in 1898 and was remodeled and expanded in 1958 as part of the Columbia River Fishery Development Program (Mitchell Act). Current production consists of rearing upriver bright fall and spring Chinook salmon. Coho are raised, but no longer released at Willard NFH, which is administered by Little White Salmon. Willard is listed separately in this document.

### **Spring Chinook**

Both age-0 and yearling spring Chinook have been released from the hatchery. Brood years 1982 through 1984 were coded-wire tagged to evaluate age-0 and yearling releases. Average survival for age-0 fish was 0.11%, compared with an average survival of 0.39% for yearling releases. Columbia River gill nets took a greater proportion of age-0 fish than yearlings (9.7% vs. 3.2%) for these three broods. Release of coded-wire tagged age-0 fish was resumed with brood year 1991.

Marking of spring Chinook resumed for brood year 1988 under the Missing Production Group program. Brood year 1988 fish released at age-0 were not marked. The overall survival rate for yearling fish from this brood year was 1.0457%. Nearly 2,400 yearling release fish were harvested in the Columbia River, with over 1,500 in the WDFW reported freshwater sport fishery alone. Another 730 fish were taken in the treaty ceremonial fishery.

Brood year 1989 shows a total survival of 2,270 fish, or 0.2230%, down from last year with the elimination of an age-2 recovery. Nearly 1,200 fish were taken in the freshwater sport fishery, and 85 in the treaty ceremonial fishery. Age-0 fish were released, but without a coded-wire tag.

The survival rate for brood year 1990 is 0.0155% with no reported off station recoveries. Coded-wire tagged fish from this brood year were released from the Willard NFH facility, (a sub-station located upstream from Little White Salmon NFH) along with a total of 869,952 fish. Another 807,742 untagged, unmarked fish were released at Little White Salmon NFH. There was no age-0 release from this brood year.

Only 232 fish survived out of 809,079 yearling fish released from brood year 1991 (0.0287%), using the rd2 program. There were only 7 recoveries, identical to brood year 1990. There were no recoveries from 94,295 tagged fish released at age-0.

Brood year 1992 yearlings now have a survival rate of 0.5456% and an estimated total survival of 5,426 fish. Over one thousand fish were caught in the WDFW freshwater sport fishery, and another 790 in the freshwater net fishery.

Fingerlings from brood year 1992 now have an estimated survival rate of 0.0121%, or only 61 fish from a release of 503,458.

The rd2 program estimates total survival as 0.2175% for brood year 1993. Recoveries from 1997 are expanded to 330 freshwater net, and 709 freshwater sport recoveries. There were an additional estimated 16 fish harvested in the treaty ceremonial fishery. This brood year has a below average survival rate.

Estimated survival for brood year 1994 is 0.0385%, the third lowest percentage on record. Only 18 fish were estimated to have been taken in the treaty ceremonial fishery with just 352 returning to the hatchery.

Survival for brood year 1995 is estimated to be 0.4042%, which places it in the mid-range of survivals. Recoveries occurred in freshwater sport (257), treaty ceremonial (34), gill net (26), and on spawning grounds (12) in addition to 2,381 returns to the hatchery.

The estimated total survival for brood year 1996 is 0.4352%, in the top half of survivals. Freshwater sport (723) and treaty ceremonial (285) fisheries were responsible for the majority of off station recoveries with an estimated 131 fish also being taken in the Columbia River gill net fishery.

Brood year 1997 is in the middle of survivals with 0.3685%. More than twenty-three hundred fish were harvested in Columbia River sport fisheries. Seven hundred twenty fish were taken in the Columbia River gill net fishery and 96 as treaty ceremonial.

A survival rate of 0.6306 puts brood year 1998 third best of all Little White spring Chinook releases. This brood year contributed over twenty-five hundred fish to sport fisheries, eleven hundred to the gill net fishery, and 174 to treaty ceremonial harvest.

The estimated 0.1446% survival rate for brood year 1999 is in the middle of completed brood years. Nearly one thousand fish were harvested in the Columbia River in sport (705) and gill net (225) fisheries.

The release of one million plus brood year 2000 fish resulted in a total contribution of 2,655 and a calculated return to the hatchery of 1,138. Percent survival is 0.2559. Columbia River contribution is 1,474, higher than return to the hatchery (1,138).

Survival is halved for brood year 2001 at 0.1013%, only 50 observed recoveries, and an estimated total of 1,025 recovered. Only one tagged Age3 fish was recovered at the hatchery, while age composition shows 12 jacks while the hatchery jack count was 17. ODFW estimated sport catch is 337, and the gill net catch is 161.

Ocean fisheries north of Oregon hit Age4 fish from brood year 2002, taking about one hundred twenty fish. This brood year had a strong survival of 0.6334%, the third highest to date for Little White spring Chinook. Twenty-four hundred fish were caught in the Columbia basin sport fisheries, and 372 in gill nets.

### **Upriver Bright Fall Chinook**

Brood year 1983 through 1985 upriver brights were marked for both a normal age-0 release and an extended rearing release. Average percent survival for the fingerling release from these three brood years was 1.1%, compared to the survival of 0.3882% for the extended rearing fish. The extended rearing program strategy is no longer being used. The survival rates for two of the three brood years with extended rearing are ranked fourth and fifth of eighteen releases for this program.

Brood year 1989 was the first upriver bright brood year to be marked under the Missing Production Group program. Fifty-eight observed recoveries were expanded to a total of 3,530 for an overall survival rate of 0.2454%. Most of the harvested fish were taken in the ocean (1,733), with 931 in Alaska, 577 in British Columbia and 225 in California. An additional 160 fish were harvested in the Columbia River gill net fishery, and 642 were recovered in spawning ground surveys.

Current recovery information and use of the new rd2 program shows a 0.3285% recovery rate for brood year 1990, higher than that for brood year 1989.

Little White Salmon upriver bright fall Chinook appear to be the only group of fish in this report which had a higher rate of survival for brood year 1990 than brood year 1989. Unlike Spring Creek tule fall Chinook, where fish were released in March, April, and May, these fish were released in June. These upriver bright fish are also recovered farther north than Spring Creek tules. Alaska ocean troll and ocean sport took most of these brood year 1990 fish (2,161), followed by Canadian troll and ocean sport fishers (1,844), and the Columbia River gill net fishery (1,041). Spawning ground surveys account for an additional 1,047 fish.

Survival for brood year 1991 is 0.2039%, approximately 60% of brood year 1990. Alaskan troll (856) and British Columbian fishers (570) harvested fish in the ocean, and the Columbia River gill net fishery took 920 fish. Although brood years 1990 and 1991 had very low survival rates basin wide, these releases are in the middle, and fifth from the lowest.

The estimate of survival for brood year 1992 is now 0.3623% with a total survival of 6,763 fish. WDFW added 6 observed spawning ground recoveries in 1998. Alaska and British Columbia ocean fisheries took 787 and 118 fish respectively. Columbia River gill nets took 1,140 fish, and the river sport fishery accounted for 275. Survival for this brood year is average.

Survival from brood year 1993 is now 13,540 fish or 0.7531%, more than double the survival for brood year 1992. This is the second best survival for this hatchery and species. Alaska and Canada took nearly equal shares in the ocean catch (1,545 and 1,222), and over thirty-five hundred fish were harvested in various Columbia River fisheries.

Brood year 1994 is now estimated to have survived at a rate of 0.0826%, only about one ninth the rate of the previous brood year, and the next to lowest for this hatchery and species. Alaskan fishers took 229 fish from a total of 309 estimated recoveries in the ocean. An estimated 299 fish were recovered in Columbia Basin spawning ground surveys.

The estimated survival for brood year 1995 is 0.2422%, with over nine hundred recoveries in Alaskan waters, from a total 5,079 estimated recoveries. This survival is in the lower half of survivals for this hatchery and species.

Brood year 1996 is in the lower third for Little White Salmon upriver bright fall Chinook at 0.1388%. Even so, fish were recovered in Alaska (764) and California (44) ocean fisheries.

Brood year 1997 is in the upper third of the survivals at 0.4139%. Nearly eleven hundred fish were harvested in Alaskan waters. The five thousand plus fish recovered in the Columbia River are particularly noteworthy. Over three thousand of those resulted from WDFW conducted spawning ground surveys. This high number of estimated spawning ground recoveries is undoubtedly due to the hatchery restricting the number of fish entering the adult holding pond during spawning season. This practice was begun in 2000. This brood year contributed fifteen hundred fish to the Columbia River gill net fishery.

Overall survival for brood year 1998 is now 0.3617%, a bit lower than the previous brood year. The expansion factor for eighteen 2003 recoveries observed in the Columbia River Gill net fishery by ODFW has been reduced, lowering the resultant expanded recoveries from 111 to 42. Over twelve hundred fish were harvested in Columbia River gill nets. Over twenty-six hundred fish from brood year 1998 are estimated to have been recovered on spawning grounds. Spawning ground recoveries were no doubt higher than usual due to the fact that all returning fish were not allowed to enter the Little White Salmon adult holding building.

Intermittent ladder operations occurred at Little White Salmon NFH during 2002-2004.<sup>iii</sup>

Spawning ground recoveries expand to nearly seven thousand fish for brood year 1999. This is a result of restriction adult returns to the hatchery. The estimated total survival is 16,473 fish or 0.8359%, the second highest survival to date. Close to four thousand fish were taken in Alaska non-treaty troll fisheries, and about twenty-five hundred in Columbia River gill nets.

The current estimate of survival for brood year 2000 is 0.3194% and a total survival of 6,189 fish. Alaskan fisheries took the lion's share of this brood year with 1,480 being caught mostly by trollers. Eighteen hundred fish found on spawning grounds are again the result of the hatchery preventing a large part of the returns from entering the hatchery.

Brood year 2001 is in the bottom third of successful years with an estimated survival of 0.1950%. Harvest was split roughly equally between ocean and fresh water (1,430 vs 1,803). In the ocean Alaska harvested the greatest number by far (1,169) followed by 230 by BC, and 31 in WA. Intermittent ladder operations sent an estimated 917 fish onto spawning grounds while another nine hundred fish were harvested in river with 636 taken in gill nets.



## **Spring Creek National Fish Hatchery**

Spring Creek NFH is located on the Columbia River at Underwood, Washington, about 30 miles upstream of Bonneville Dam. Elevation at the hatchery is 93 feet above sea level. The hatchery was constructed in 1900 and began operations a year later. Fish were trapped in the Big White Salmon River from 1901 through the 1950s. Spring Creek NFH was remodeled in 1955 under the Mitchell Act, and redone again in 1970 under the John Day Mitigation Act. Spring Creek NFH currently produces tule fall Chinook.

The survival rate for brood year 1984 was 0.0462%, and was 0.1294% for brood year 1985. Even with the low survival rate of these two brood years, thousands of fish were harvested in both the ocean and the Columbia River.

Survival for brood year 1986 is estimated at 0.4328%, 46,050 fish from a release of 10,640,406. Over 22,000 fish were harvested in the ocean and 14,288 were taken in the Columbia River gill net fishery.

Brood year 1987 fish were recovered primarily in commercial fisheries off the coasts of Canada and Washington, as well as in the Columbia River gill net fishery. Total survival for the 1987 brood year is 0.3087%, or 27,326 fish from a release of 8,850,757.

Brood year 1988 fish were recovered primarily in the Columbia River gill net fishery (24,168). They also contributed to the ocean fisheries in Washington (17,417), Canada (11,671), and Oregon (6,319). Overall survival is estimated at 0.5168%.

Fish from brood year 1989 fared slightly worse than brood year 1988 with an overall survival rate of 0.4855% or 49,683 fish. The greatest number of recoveries was in the ocean off Washington (14,894), and in the Columbia River (12,548). The Columbia River gill net fishery took the great majority of fish harvested in the Columbia River. British Columbia took 9,984 fish, and ocean harvest off Oregon totaled 3,551 fish.

The estimated total survival for brood year 1990 drops to 0.1295%. This is one of the lower survival rates since brood year 1980. Most of the harvest of these fish occurred in the Columbia River, 5,017 fish, followed by the Washington ocean harvest of 4,811, and the Canadian harvest of 3,345.

Brood year 1991 survival rate, expanding for each coded-wire tag, is 0.1374%, only slightly better than brood year 1990. British Columbia ocean troll and ocean sport fisheries took the largest number of fish from this brood year at 7,787 fish. The Columbia River gill net fishery harvested 7,001 fish.

Survival for brood year 1992 is 0.1620%, or 23,488 fish. The Columbia River gill net fishery harvested 10,508 fish, and 3,119 were taken in the ocean. The great majority of fish harvested in the ocean were taken by Canadian fishers. Brood year 1992 was the first year of a three year fin clip study at Spring Creek, and the PEF method was used for this calculation.

Brood year 1993 survival was greater than 1992 at 0.2197%. This survival rate was calculated by the rd program. Oregon reported slightly more ocean recoveries than Canada, but the Columbia River gill net fishery harvested greater than three times more fish than the combined ocean harvest. This brood year contributed more than twenty-four thousand fish to fisheries. The 1993 brood year was the second of three years of a three year fin clip study at Spring Creek.

In the third year of the fin clip study (brood year 1994) fish were released

which were not represented by any recoverable coded-wire tags. Therefore, the PEF method was used (rd.prg). Survival is now estimated to be 0.1038%. Nevertheless, 4,430 fish were harvested in the ocean, mostly in British Columbia. An additional 6,259 fish were harvested in the Columbia River.

The current total survival estimate for brood year 1995 is 0.0492%, the lowest since brood year 1984. Nevertheless, 3,586 fish were harvested in the Columbia River, and over eighteen hundred in the ocean fisheries, the majority of which were taken off the coast of Oregon.

The estimated survival for brood year 1996 is a greatly improved 0.4249, nearly ten times better than the previous brood year, and the best survival since brood year 1990. Over twenty-six thousand fish were harvested in the Columbia River and Estuary, and an estimated 16,111 were caught in West Coast ocean fisheries. Seventy-two hundred fish were harvested in WDFW reported ocean fisheries, fifty-five hundred in Oregon, and three thousand in British Columbia.

There are now over one thousand observed recoveries from brood year 1996, and the estimated survival is 0.4250%. Ocean harvest was highest for Washington (7,247), Oregon (5,492), and British Columbia (3,093). Over twenty-six thousand fish were harvested in the Columbia River fisheries, with 19,213 fish making it back to the hatchery (when calculated by expansion). Nevertheless, this return is near the median for Spring Creek tules.

Changed expansion factors and additional recoveries raise survival to 0.1145% for brood year 1997, now fourth from last for Spring Creek. Columbia River gill netters took the majority of fish off station (5,957). Canadian ocean sport and troll fishers harvested an additional 3,414. Washington and Oregon ocean fisheries took 744 and 1,129 fish respectively.

The addition of nearly six hundred observed recoveries increases the estimated survival for brood year 1998 to 1.3003%, yielding 137,732 returning or harvested fish. ODFW report the greatest number of ocean recoveries (19,361). 44,427 fish were taken in the Columbia River. WDFW reported ocean tag code recoveries that are equivalent to 12,843 fish, and CDFO catch was 8,593.

Brood year 1999 is now the most successful in the series represented in this report with a survival rate of 1.4381% and total of 83,258 fish. Columbia River contribution was 80,592, and ocean recoveries totaled 83,341.

The estimated survival is 1.1122% for brood year 2000. BC fisheries harvested over twenty thousand fish, nearly seventeen thousand by ocean trollers, and about thirty-five hundred in sport fishing. Ocean trollers were responsible for about three quarters of the 15,007 fish harvest in Washington ocean fisheries, with charter and sport fisheries taking the remaining fifty-two hundred. Intermittent ladder operations led to an estimated 4,192 on spawning grounds. <sup>iv</sup>

Survival drops to 1.0695% for brood year 2001 with another 4,502 on spawning grounds out of a total estimated survival of 172,386 fish. British Columbia fisheries harvested the greatest number of fish in the ocean (33,658), approximately the same number as was harvested by gill net in the Columbia River (33,064).

## **Warm Springs National Fish Hatchery**

Warm Springs NFH is located on the Warm Springs River, approximately 14 miles north of Warm Springs, Oregon at 1,525 feet above sea level. The hatchery was authorized in 1966 and began operations in 1978. The Confederated Tribes of the Warm Springs Indian Reservation of Oregon entered into an agreement with the USFWS to increase tribal fishing opportunities. Operations at the hatchery presently consist of adult collection, egg incubation and rearing of spring Chinook salmon.

Warm Springs has a unique fall release strategy that involves releasing the same coded-wire tags in the fall and in the spring. Therefore fall release and spring release fish are combined in this report.

The 1987 brood year is the first group of fish coded-wire tagged since the late 1970s. Since then, every fish released from the hatchery has been marked. The 1987 brood year had a 0.1272% survival and contributed mainly to the freshwater sport fishery on the Deschutes River. The number of fish released has previously been reported as 609,409 but the total released for this brood year is 661,019. The number of fish with unshed coded-wire tags is 514,633. Groups of Left Ventral (LV) and Right Ventral (RV) fin clipped fish without CWTs were also released. Ventral clipped fish are represented by CWTd fish that were raised in the same raceway. The use of either the PEF or "by tag code" method of estimating survival is problematic. The "by tag code" method was used.

As with the previous brood year, there were LV and RV fish released along with the coded-wire tagged fish and expansions were done for each CWT. Brood year 1988 survived at a rate of 0.1699%, better than brood year 1987. These fish contributed primarily to the freshwater sport fishery in Oregon and the treaty fisheries in both the Columbia River and Deschutes River.

LV and RV clipped fish were released again with brood year 1989, and the "by tag code" method was used to estimate survival. Total survival for brood year 1989 now stands at 209 fish, or 0.0195%. Sixty-three fish were taken in the freshwater sport fishery, 10 in treaty subsistence, and 4 in treaty ceremonial.

Only an estimated 30 fish survived from a release of 659,507 from the 1990 brood year, a survival rate of 0.0045%, using the rd2 program. There were 24 recoveries at the hatchery and 6 in the Oregon freshwater sport fishery.

The rd2 program for brood year 1991 yields a survival of 0.0169%, or only 94 fish. Treaty ceremonial and subsistence took a total of nine fish.

There was a big jump in survival for brood year 1992. Over eight hundred fish were recovered to give a survival rate of 0.1569%, when calculated by rd2 program, near the median of survivals. Treaty fisheries harvested 20 fish, while the freshwater sport harvest was 111.

The estimated total survival rate of 0.2564% for brood year 1993 is in the middle third of survivals. While treaty fisheries took only 3 fish, freshwater sport and fish traps recovered 57. An unusual harvest of 5 fish in California ocean fisheries was noted for this brood year. In all likelihood ODFW hatchery recoveries include the tags from 99 adults that were transferred to the ODFW Round Butte hatchery.

The brood year 1994 release at Warm Springs included fish raised from eggs received from the ODFW Round Butte Hatchery. Fish were also received from Round Butte as yearlings. Round Butte fish were coded-wire tagged and fin clipped by removing the adipose and left ventral fins. A total of 321,363

Round Butte fish were released. The total survival for this brood year is 0.1366%, near the median for this hatchery and species. Treaty fisheries reported taking 13 fish before they returned to the hatchery.

Brood year 1995 achieved a new record high survival rate in this series with an estimated survival of 0.4163%. Over nineteen hundred fish were recovered from this release. More than 95% of the fish returned to the hatchery, with 55 additional fish reported as ODFW hatchery recoveries, which are most likely from 50 adults transferred to the ODFW Round Butte hatchery. There were again recoveries reported in the California troll fishery. The treaty ceremonial fishery reported and estimated 15 recoveries.

Total estimated survival for brood year 1996 set a new record for Warm Springs spring Chinook at 0.6122%. Fish were available for both treaty fisheries (316) and freshwater sport fisheries (905) and, to a lesser extent the Columbia River gill net fishery (31).

Brood year 1997 survival continues an upward trend at 0.6641%. There were 11 expanded recoveries in the ODFW reported non-treaty ocean troll fishery from this brood year, the first time this has been observed. Most of the Columbia River Basin recoveries, which totaled 1,687, were in sport fisheries. There were an estimated 53 recoveries in tribal fisheries. This survival was adjusted due to a recalculation of the expansion rate for recoveries at Warm Spring NFH.

Brood year 1998 sets a record for Warm Springs spring Chinook with a survival of 1.4569%. There were recoveries again in the Oregon ocean troll fisheries (16). For the first time there were 3 recoveries in Alaska. Over two thousand fish were taken in freshwater sport fisheries, and nearly fifteen hundred were harvested by Columbia River gill netters. Treaty harvest was 77. This survival was adjusted due to a recalculation of the expansion rate for recoveries at Warm Spring NFH.

Although survival is only 63% of the previous brood year at 0.9837%, brood year 1999 survival is the third highest on record. (A slight adjustment in the Columbia River gill net recoveries since last year added one expanded recovery.) British Columbia and Oregon reported ocean recoveries, albeit a total contribution of 3 fish. Total freshwater sport harvest was 871 and 302 were taken in gill nets. Treaty harvest was 21 fish.

Estimated survival for brood year 2000 is 1.2396%, the second most successful on record. Twenty-six fish were harvested in the ocean, the majority of those in Canada. Tribal fishers took 9 fish in the ceremonial and subsistence fisheries. Sport fisheries reported harvest of 681 fish, and 480 were taken in gill nets.

Survival dropped to a sixth of the previous brood year at 0.2133%, for brood year 2001. Gill net recoveries totaled 53, and freshwater sport recoveries totaled 192. Treaty subsistence took another 2 fish, and 7 fish were caught from BC through Oregon.

With an estimated survival of 0.6768%, brood year 2002 is ranked fourth best of brood years to date, although ninety-four percent of recoveries were at the hatchery.

The Columbia River contribution of 152 fish shows most recovered in sport fisheries, while 21 were harvested in the ocean, as reported by CDFO.

## **Willard National Fish Hatchery**

Willard NFH is situated four miles upstream of Little White Salmon NFH on the Little White Salmon River at an altitude of 900 feet. Willard is part of the Little White Salmon NFH complex. Willard NFH was constructed in 1952 under authorization of the Mitchell Act and was originally planned as a fall Chinook hatchery. The hatchery was switched to a coho facility because of cold water temperatures. Since the mid-1960s, the hatchery has been used primarily for coho production. Adult coho were trapped and spawned at Little White Salmon NFH. Coho are presently raised for the Yakama Nation's Wenatchee River program, but no longer released at Willard NFH.

Fish from brood year 1988 contributed mostly to ocean fisheries (27,996 fish) from British Columbia (1,473) to California (5,189). An additional 8,776 fish were harvested in the Columbia River. Fifty-five hundred of those were taken in the gill net fishery, and 3,200 in the estuary sport fishery. Total survival rate was estimated to be 1.6976%.

Brood year 1989 coho survived at a rate of 0.3247%. Total survival was estimated to be 8,355 fish from a release of 2,573,323. They contributed mainly in ocean sport and non-treaty troll fisheries of Oregon (3,126) and Washington (1,779).

Using the rd2 program, total survival for brood year 1990 was only 1,722 fish or 0.1097%. Fish were harvested primarily in sport fisheries off the coasts of Washington (795), Oregon (221) and California (63). One hundred twenty-six fish were taken in the Washington non-treaty troll fishery. One hundred twenty-nine fish were taken in the Columbia River sport fishery.

Survival of brood year 1991 was even lower than 1990 with an overall survival of 0.0720%, or 2,207 fish from a release of over 3 million, using the rd2 program. The only fish harvested from this brood year were 550 fish taken in the Columbia River, 489 in the gill net fishery and 61 in the freshwater sport fishery.

There was some improvement in brood year 1992 with a survival rate of 0.1007%. Washington ocean sport fisheries took 240 fish, and Oregon ocean sport 120. The Columbia River gill net fishery took an additional 161 fish for a total off station harvest of 521 fish from a release of nearly 2 million.

Brood year 1993 survival is in the same range as the previous three broods at 0.1219% when calculated by the rd2 program. Reporting by ODFW shows 85 fish taken in the Columbia River sport harvest, and 14 at an ODFW hatchery. All other recoveries were at Little White Salmon NFH.

The estimate of survival for brood year 1994 is 0.2379%, a total of 5,602 fish, most of which were adults returning to the hatchery. Coho from the WDFW Kalama River hatchery were released as part of this brood year, and did not have a unique coded-wire tag. Since there was no representative coded-wire tag for these fish, the rd program was used to estimate survival.

The survival for brood year 1995 is 0.5383%, now the third best during the 1990s. This higher survival rate is to a large extent due to the release at Little White (rather than Willard) of coho from the ODFW Klaskanine hatchery. CWT recoveries show that these fish survived at a rate over 3 times higher than the Willard fish. There were an estimated 928 recoveries in the ocean and 1,918 in the Columbia River. The Klaskanine fish were 100% adipose fin clipped, and, although there was a coded-wire tag only (no adipose fin clip) group released this brood year, Willard coho were not "mass marked" with an adipose fin clip.

Brood Year 1996 Bonneville coho, some raised at the ODFW Cascade hatchery, and eggs incubated at the Eagle Creek NFH, were released along with Willard fish to make up this brood year. Bonneville stock fish did not receive a unique coded-wire tag. A PEF was calculated for this brood year. The calculated total survival of 0.156% was higher than only three other brood years. Only 72 fish from this brood year were caught in the ocean, and just 324 in the Columbia River.

The estimation of total survival for brood year 1997 is 0.8639%. This appears to be the first brood year that was mass marked by removing the adipose, except for one group with a coded-wire tag and no adipose fin clip. The brood year has the second highest rate of survival to date. Ocean fisheries reported by ODFW account for 1,286 adults harvested, compared to 724 reported by WDFW, and 1,450 in the Columbia River.

ODFW recoveries for brood year 1998 are once again in the RMIS database, and total survival is now estimated at 1.0344%. Nearly five thousand fish were harvested in Washington ocean fisheries, 1,853 in ODFW reported ocean fisheries, and 3,931 fish were taken in the Columbia River.

Both Little White and Eagle Creek stock were released for brood year 1999, and the two stocks did not receive separate coded-wire tags. Releases for brood year 1999 included two coded-wire tags, one of them a "double index" tag where fish were not adipose clipped; and with an adipose clip. This is now standard operating procedure. However, it appears that the DIT tag was put into fish from Eagle Creek which were raised and released at Willard. Estimated survival for brood year 1999 is 0.2821% with 385 ocean recoveries and a contribution of 818 in the Columbia River.

Changes in WDFW reporting give brood year 2000 increases survival to 1.1865%, the second best survival rate to date. Ocean contribution is now estimated to be 4,522 with the harvest there split almost equally between Washington and Oregon reported fisheries. Approximately nine hundred fish were caught by Columbia River gill net and estuary sport fishers. Close to five hundred fish total were estimated to have been found in spawning ground surveys by both ODFW and WDFW.

The brood year 2001 release did not fare as well, with an estimated survival of 0.8227%, but still had the fourth highest survival rate. Ocean contribution was 1,133 fish while Columbia River non hatchery recoveries were 453 with 197 of those in spawning ground surveys.

The last release coho at Willard NFH was of brood year 2002 fish, and fish were released in January at 25/#, rather than in April at 15/#. The estimated survival for these fingerlings is 0.0757%. Only 63 fish were taken in various Columbia River fisheries with an ocean harvest of 84.

## **Winthrop National Fish Hatchery**

Winthrop NFH is situated along the Methow River, near the town of Winthrop, Washington. Elevation is 1,760 feet above sea level. Nine dams separate Winthrop from the Pacific Ocean. The hatchery is authorized by both the Grand Coulee Fish Maintenance Project (1937), and the 1938 Mitchell Act.

The facility began operations in 1942 by trapping adult sockeye and steelhead at Rock Island Dam and transporting them to the hatchery. By 1951 the hatchery was rearing sockeye, spring Chinook, steelhead, kokanee, coho, and resident trout. Until 1996 the program had been simplified to spring Chinook only. Coho and steelhead now being raised at Winthrop have not been coded-wire tagged. Tagged summer Chinook were released in 1996.

### **Spring Chinook**

Spring Chinook were coded-wire tagged beginning with brood year 1989. There were 16 observed recoveries from the 107,670 tagged fish released. Using the newer rd2 method of expanding for each tag code, these recoveries are expanded to a total of only 81 fish for an overall survival rate of 0.0077%. An estimated 27 fish were recovered in the freshwater sport fishery, and an estimated 10 fish were recovered by WDFW hatcheries.

All spring Chinook yearling fish released from Winthrop beginning with brood year 1990 have had representative coded-wire tags. Therefore, the rd2 program has been used for all subsequent brood years.

There is only one recovery from coded-wire tagged brood year 1990 Winthrop spring Chinook. That recovery was at a WDFW hatchery. This recovery is expanded to a total of 8 to include unmarked fish that were probably also killed at that hatchery. The overall survival rate is therefore estimated to be 0.0013%.

There are no brood year 1991 recoveries from the 189,187 tagged fish released. Brood year 1992 contributed an estimated 74 fish to a WDFW freshwater fish trap from the total estimated recovery of 94 fish, a survival rate of 0.0169%.

Survival for brood year 1993 has been reported as the highest on record to date for Winthrop at 0.0429%, up from last year. WDFW reported more hatchery recoveries than USFWS, and there were no other off station recoveries. It appears that 8 USFWS recoveries are missing from RMIS.

Brood year 1994 sets the new record for Winthrop Spring Chinook at 0.0543%. Fifty-eight of the hatchery recoveries were reported by WDFW. These adults were trapped at Wells Dam and taken to the WDFW Methow hatchery. There was also one spawning ground survey recovery at river mile 48 in the Methow River.

Brood year 1995 fish were raised and released at both Winthrop NFH and Methow SFH. Release records in the RMIS database (reported by WDFW) are somewhat different than records provided by Winthrop. Returning fish from this brood year were captured at Wells Dam and transported to Winthrop NFH. Thus, there were 117 WDFW reported hatchery recoveries vs. 3 FWS reported hatchery recoveries. Two fish were recovered in Canadian ocean fisheries, and the only other recoveries were in the WDFW spawning ground group. Total survival for this brood year is estimated at 0.8609%. Although this is by far the highest survival to date, the unusual circumstances must be noted.

The addition of four WDFW gill net fishery recoveries increases the estimated rate of survival to 0.3559% for brood year 1996 Winthrop spring Chinook. WDFW recoveries yield an estimated 139 fish recovered on spawning grounds, all age-

4 fish in the year 2000. Three fish were reported caught by Alaska.

Survival for brood year 1997 is lower than for 1996 at 0.2836%. The half million release produced an estimated contribution of 1,546 jacks and adults. Gill net and sport fisheries intercepted the greatest number of fish: 507 and 378 respectively.

The brood year 1998 release of 364,632 fish yielded a contribution of 1,440 for a survival rate of 0.3813%. Columbia River harvest was split almost equally between gill net and sport fisheries. Returns to the hatchery were also split nearly equally between FWS and WDFW.

Survival for brood year 1999 is 0.0444%, in the middle of survivals for Winthrop, but still about one tenth of the previous brood year. Based on this accounting, only 48 fish returned to the hatchery, while another 30 were harvested or found elsewhere. However, it should be noted that the return to the hatchery by coded-wire tags is less than one tenth of the number by age composition.

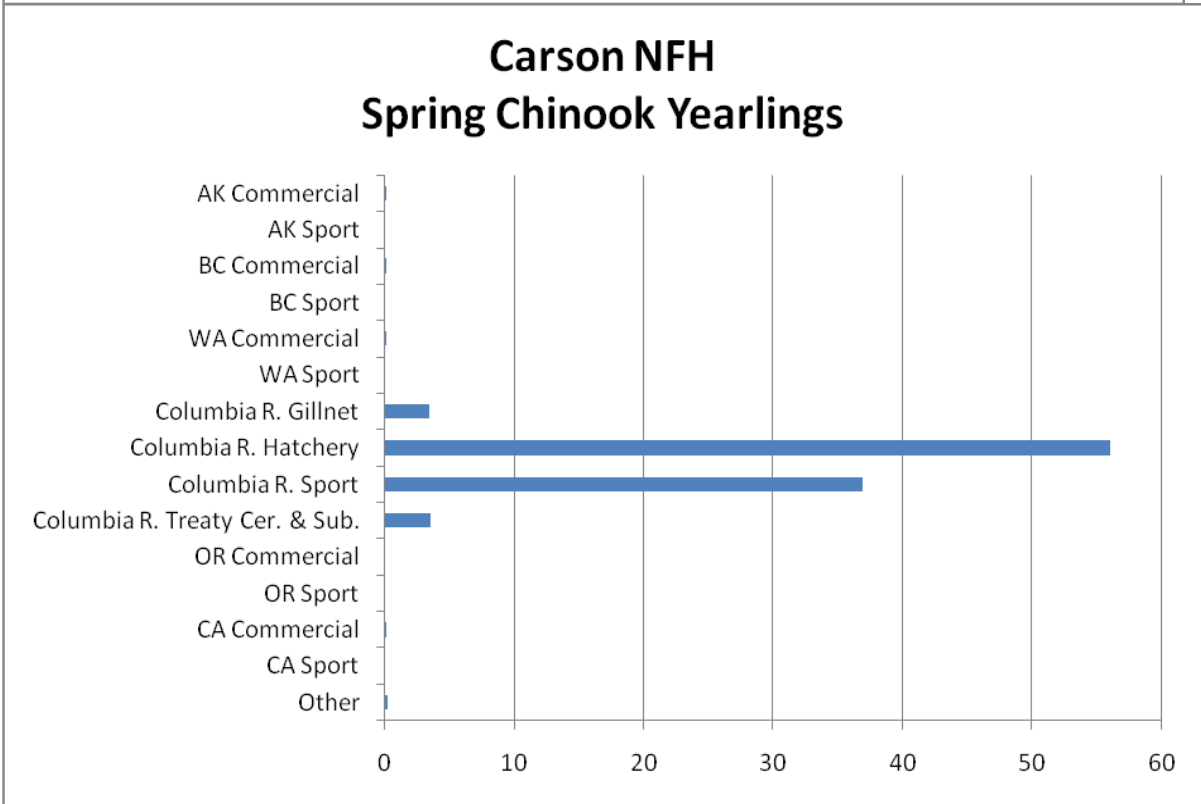
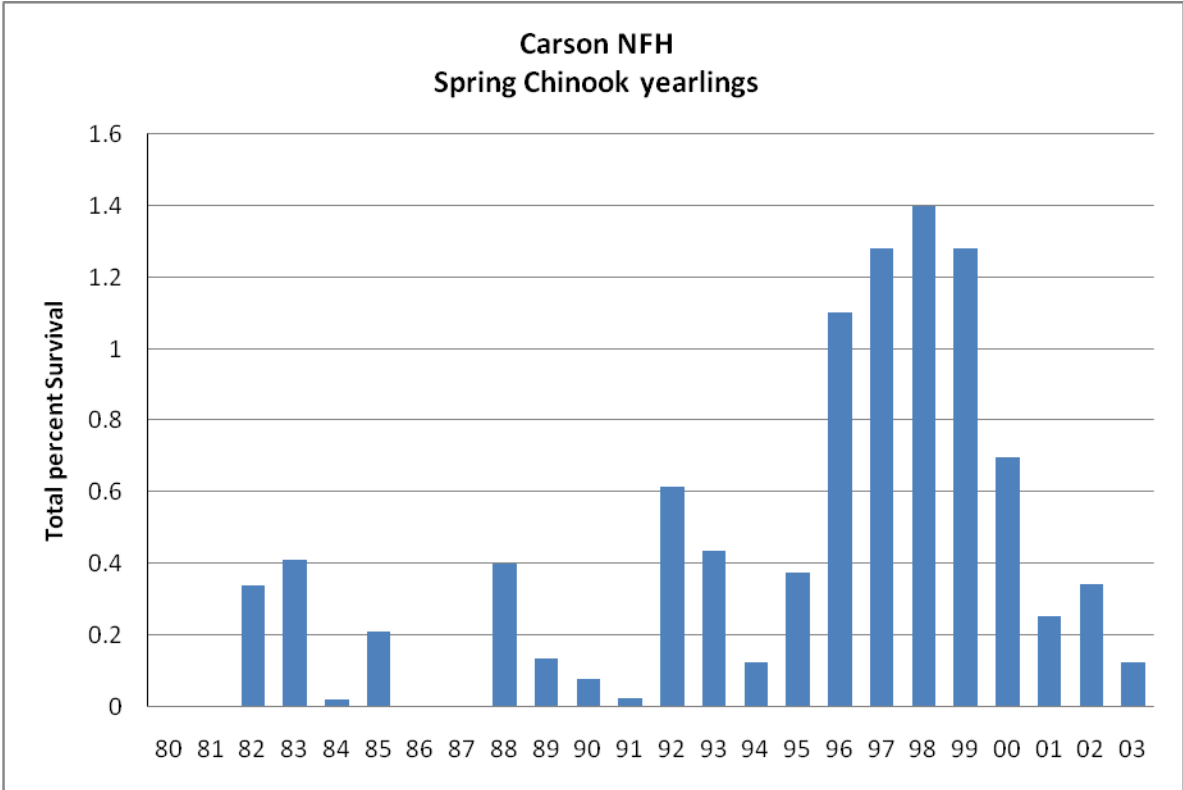
The addition of fourteen new observed recoveries yields a total survival of 0.3041%, putting brood year 2000 in fourth place in Winthrop history. About one fourth of fish recovered at hatcheries were recovered at the nearby Methow Hatchery. Another 132 fish, more than recovered at the Methow Hatchery, were found in spawning ground surveys.

An examination of the relationship between hatchery recoveries and spawning ground recoveries shows that the proportion of Winthrop fish recovered on spawning grounds has increased dramatically from the early 1990s through the early 2000s. A combination of high survival rates for recent brood years, ESA issues, and co-manager agreements in the Methow Basin required hatchery staff to block returning fish from entering the hatchery after the hatchery escapement goal had been reached.

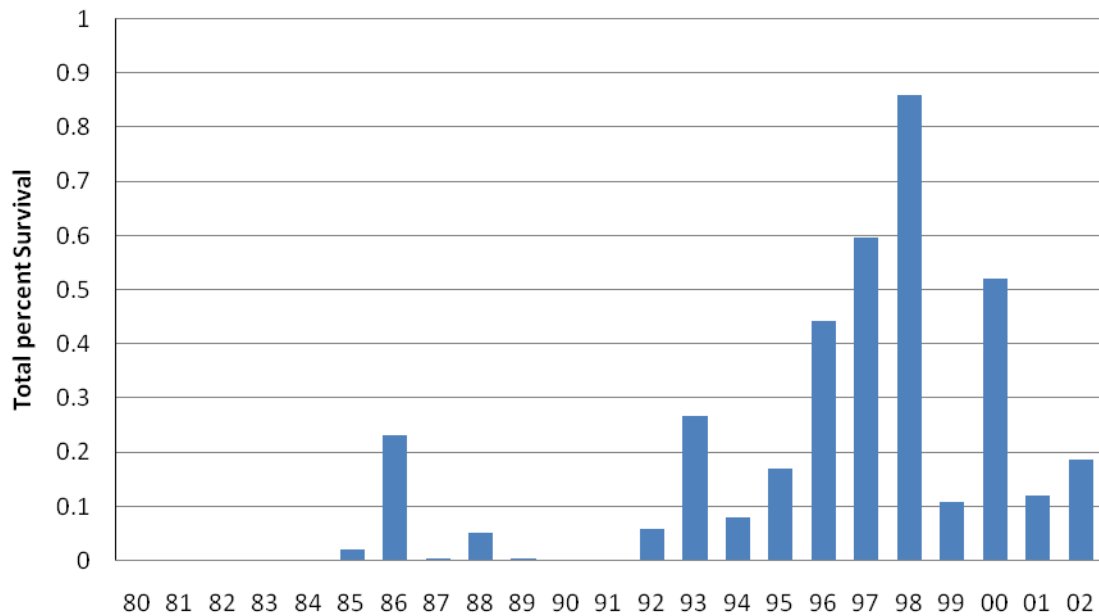
The calculated survival for brood year 2001, 0.1154%, is below average for Winthrop spring Chinook to date. Spawning ground recoveries were again a large part of "recovered" fish, estimated at 141 from a total "survival" of 533. About 36 fish were taken in fisheries within the Columbia River Basin.

2002 brood year has essentially the same estimated survival at 0.1134%. An even greater proportion of recoveries were in spawning ground surveys, 222 out of 656 total estimated survival.

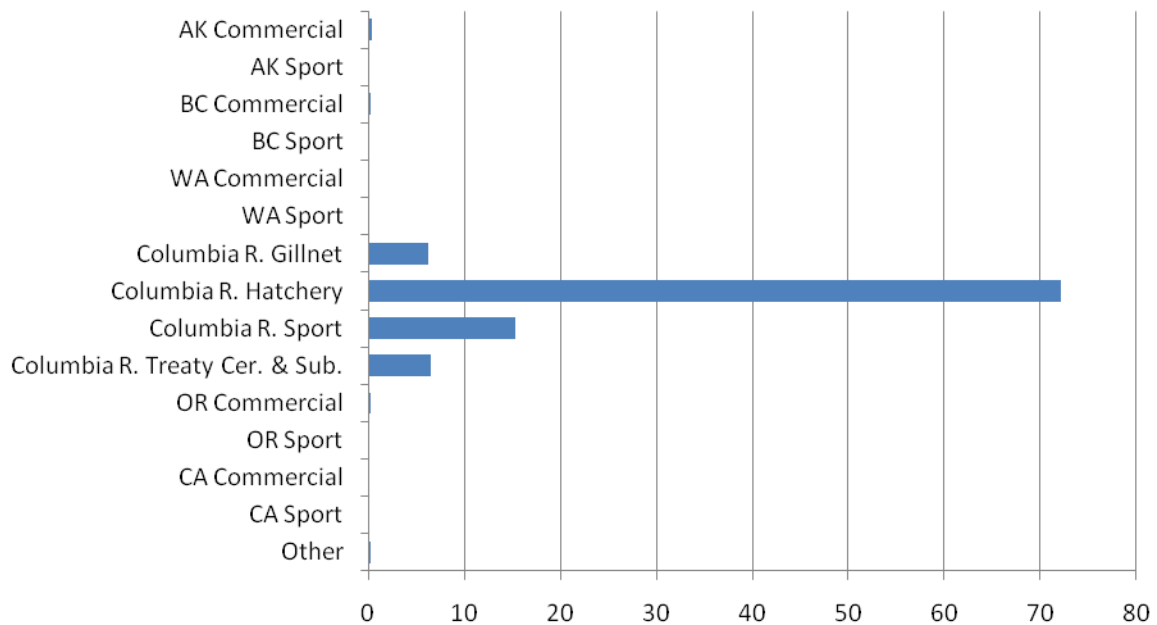




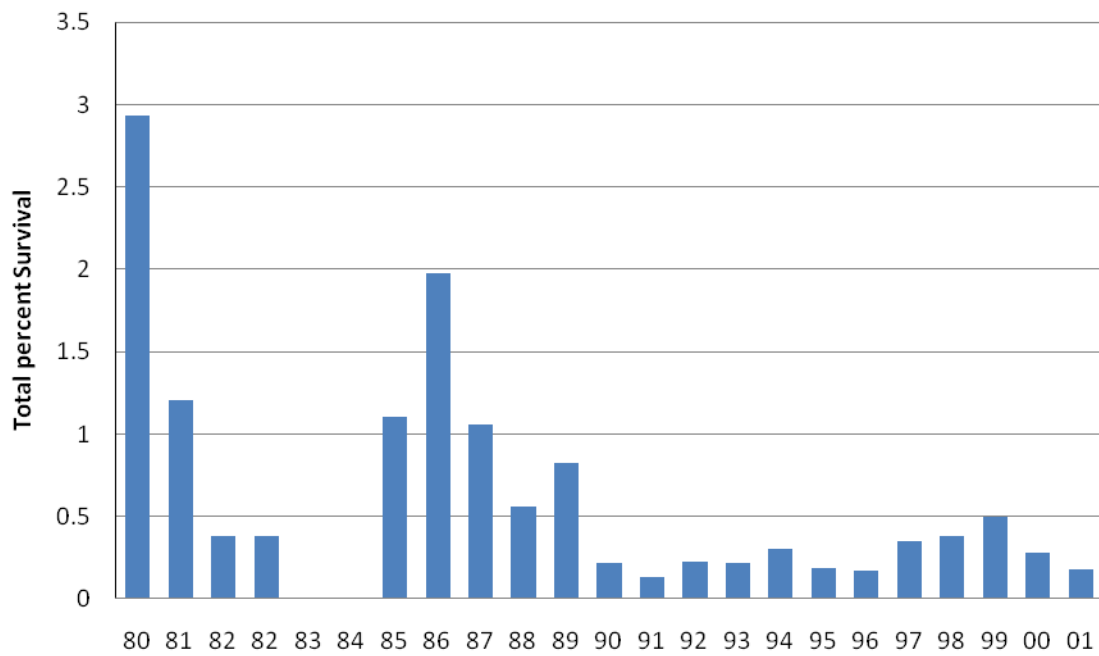
## Dworshak NFH Spring Chinook yearlings



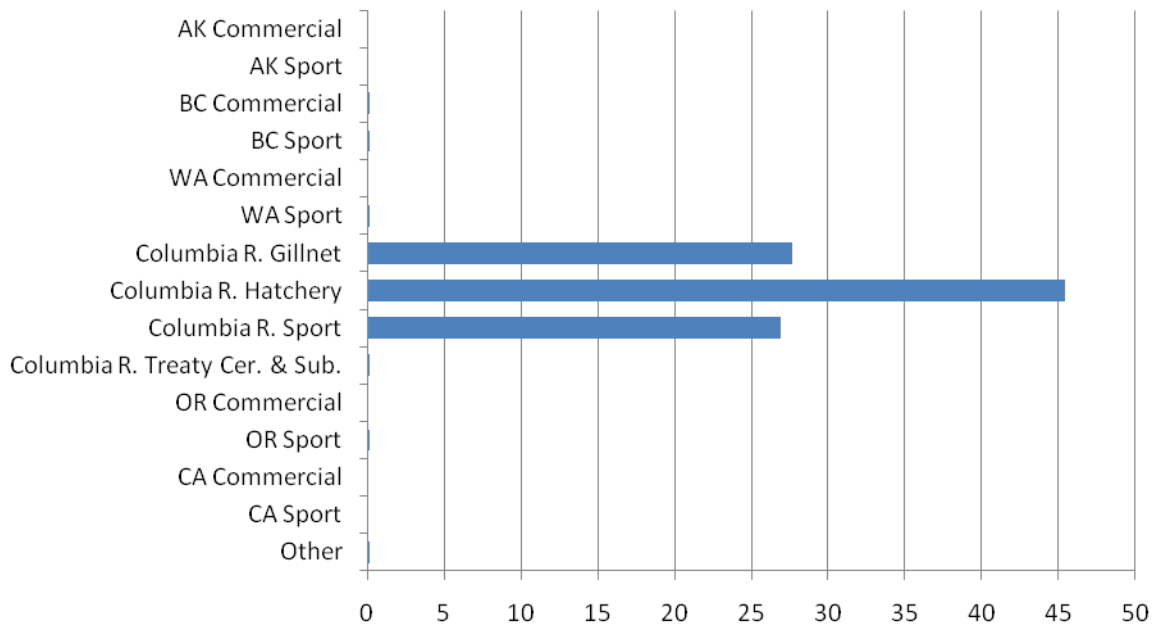
## Dworshak NFH Spring Chinook fingerlings



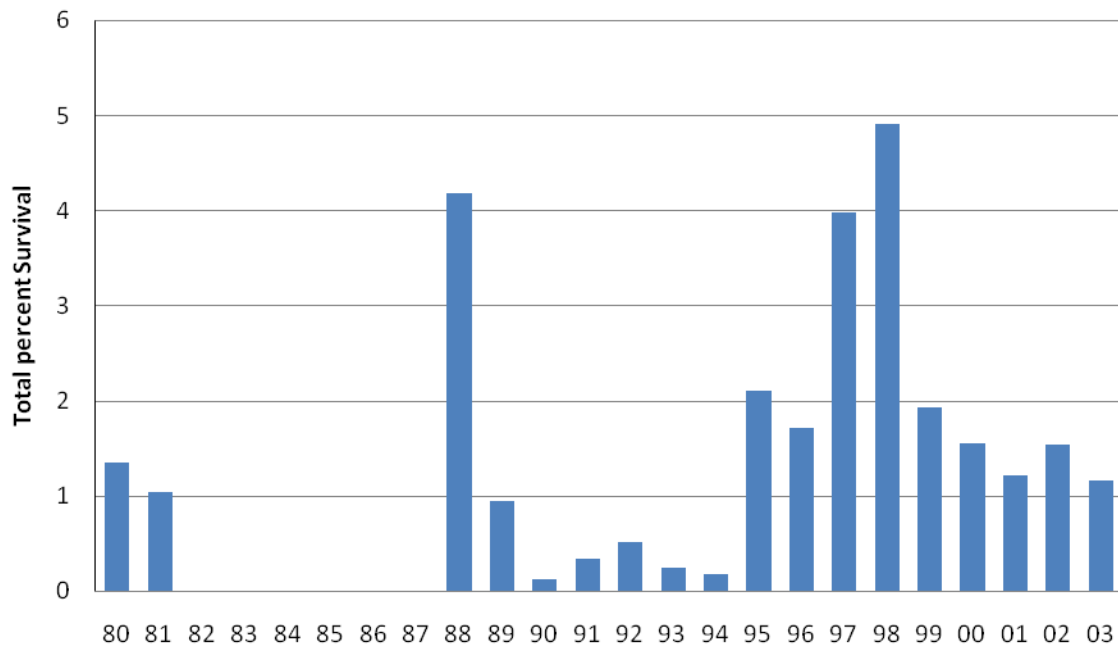
### Dworshak NFH Summer Steelhead yearlings



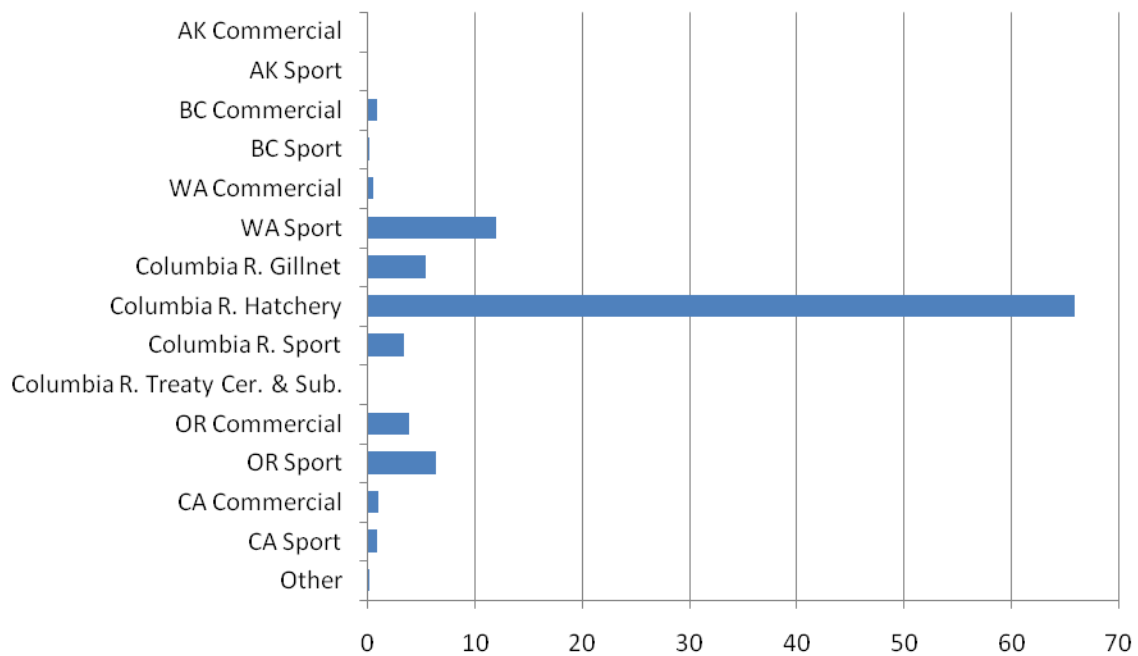
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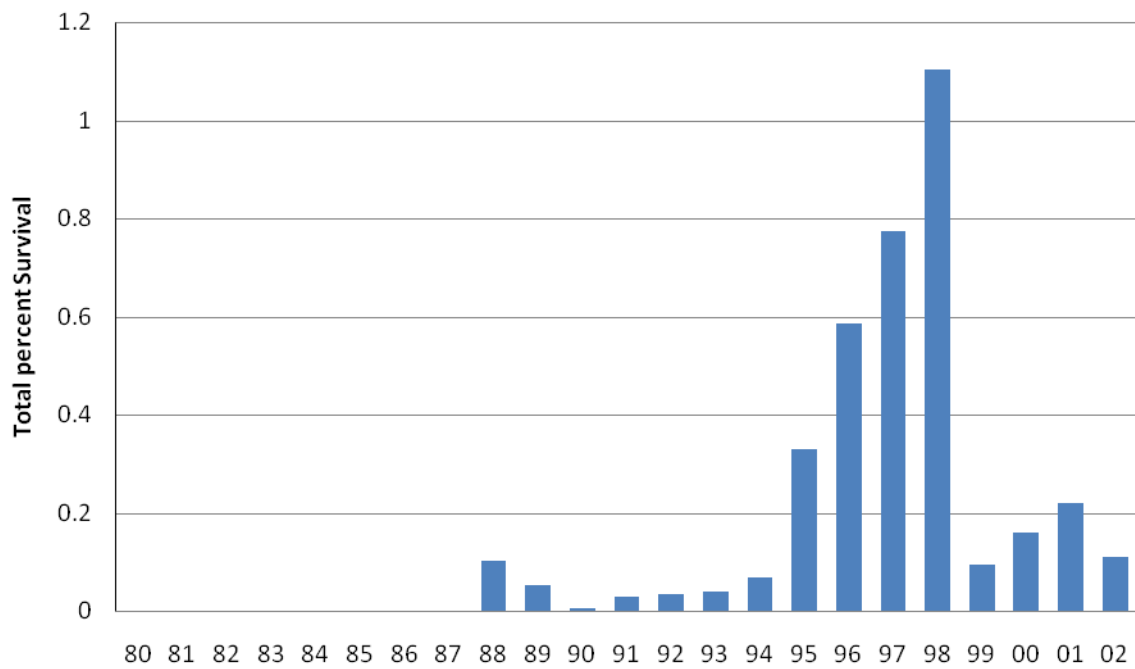
### Eagle Creek NFH Coho yearlings



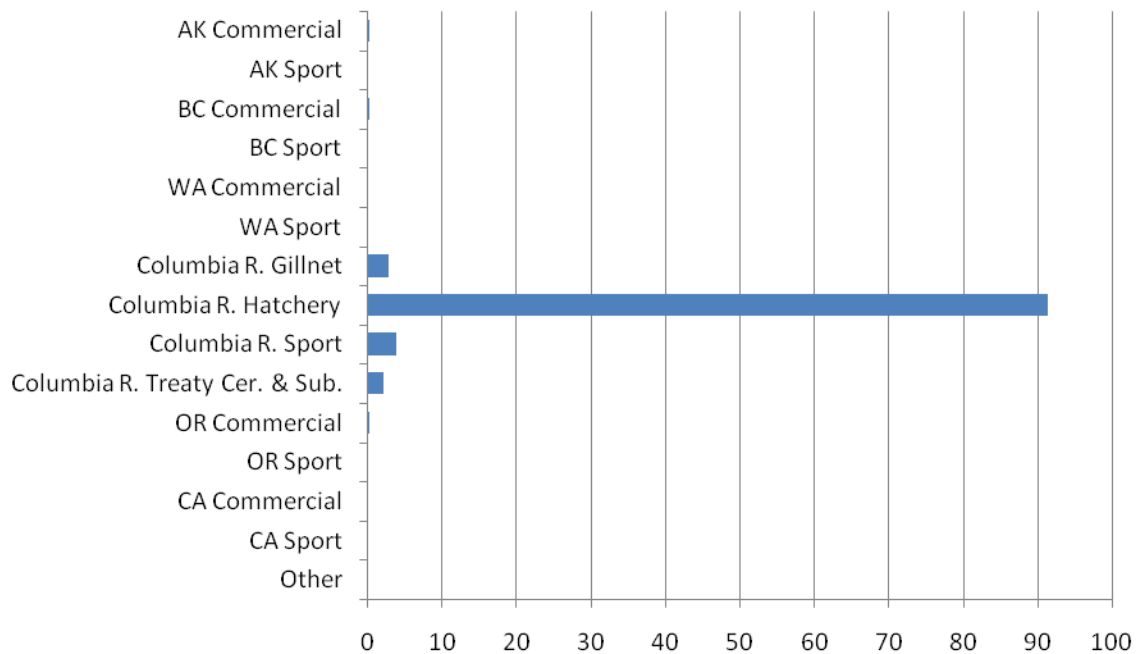
### Eagle Creek NFH Coho yearlings



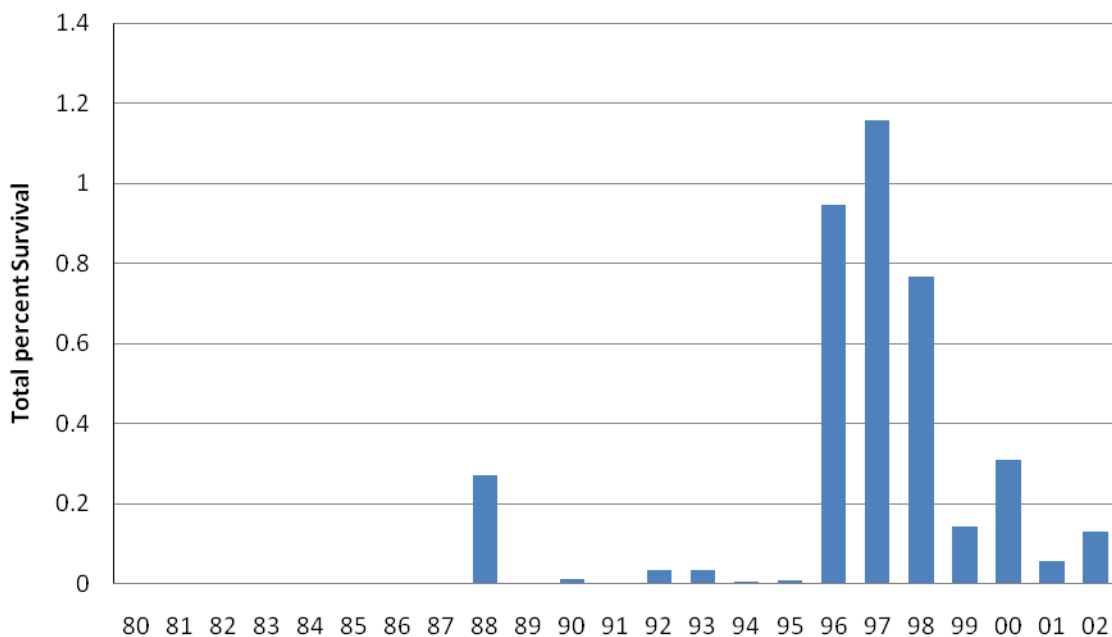
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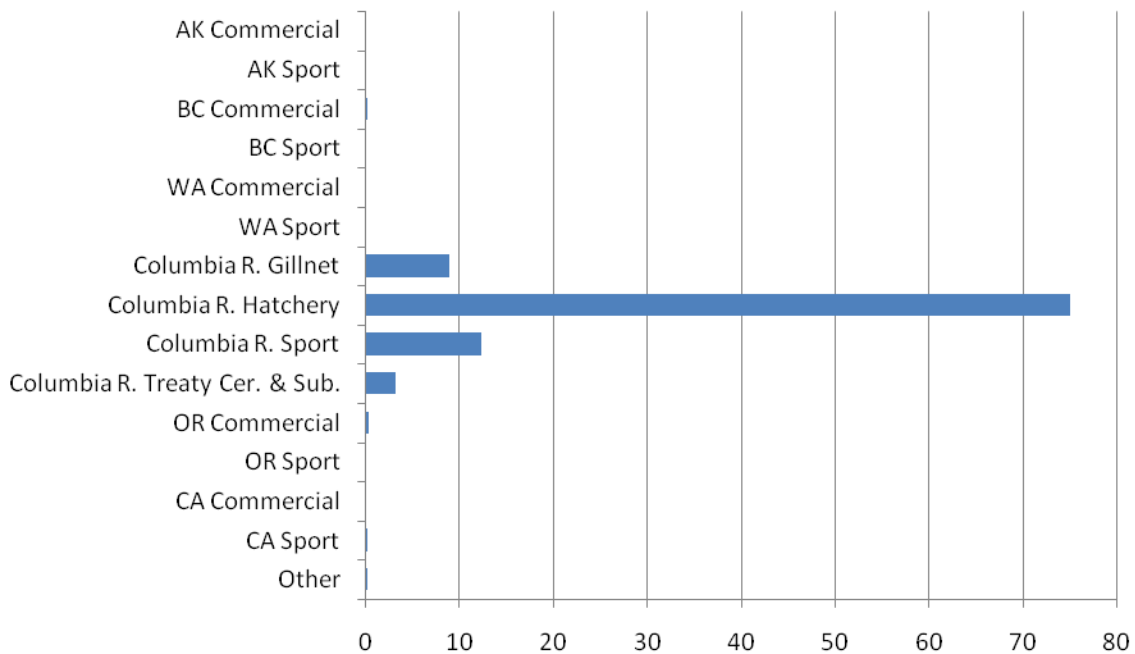
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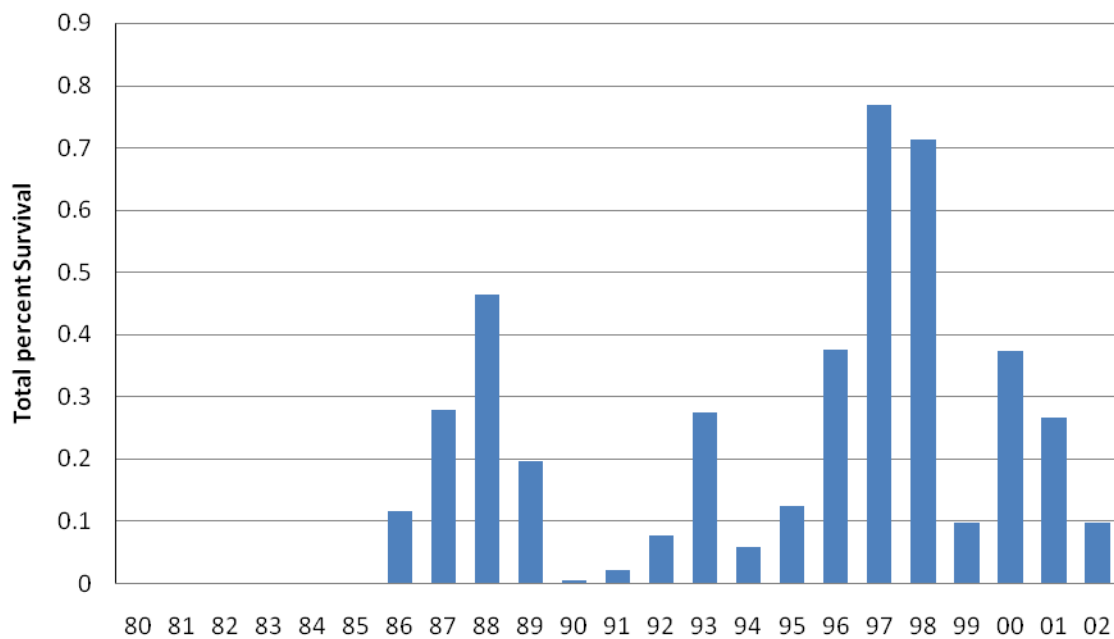
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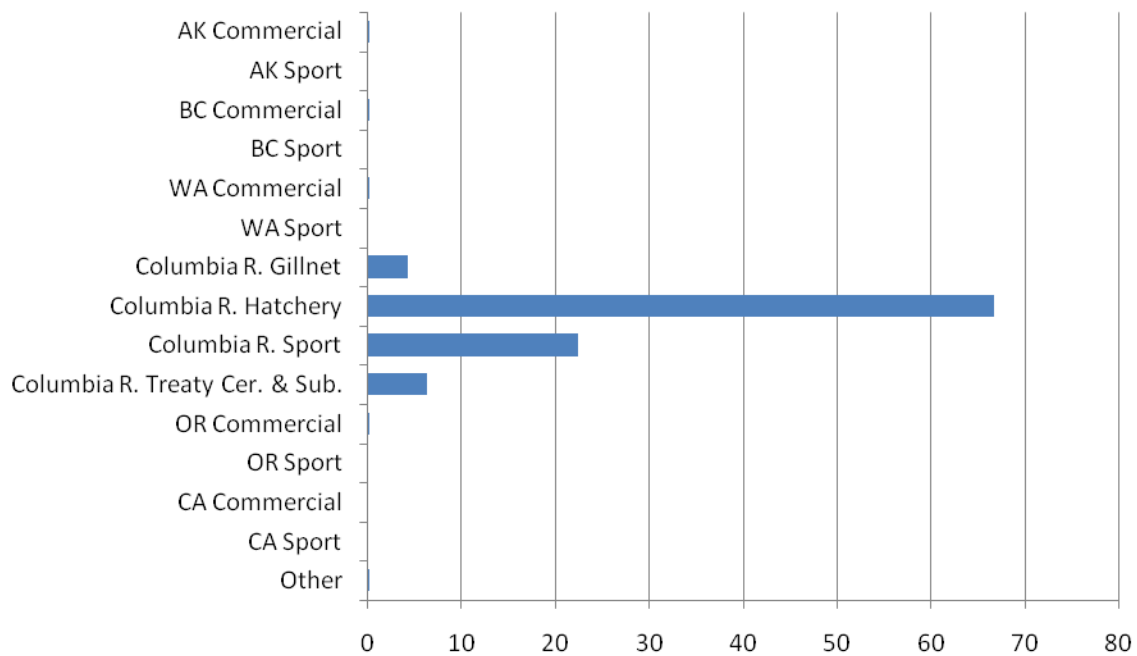
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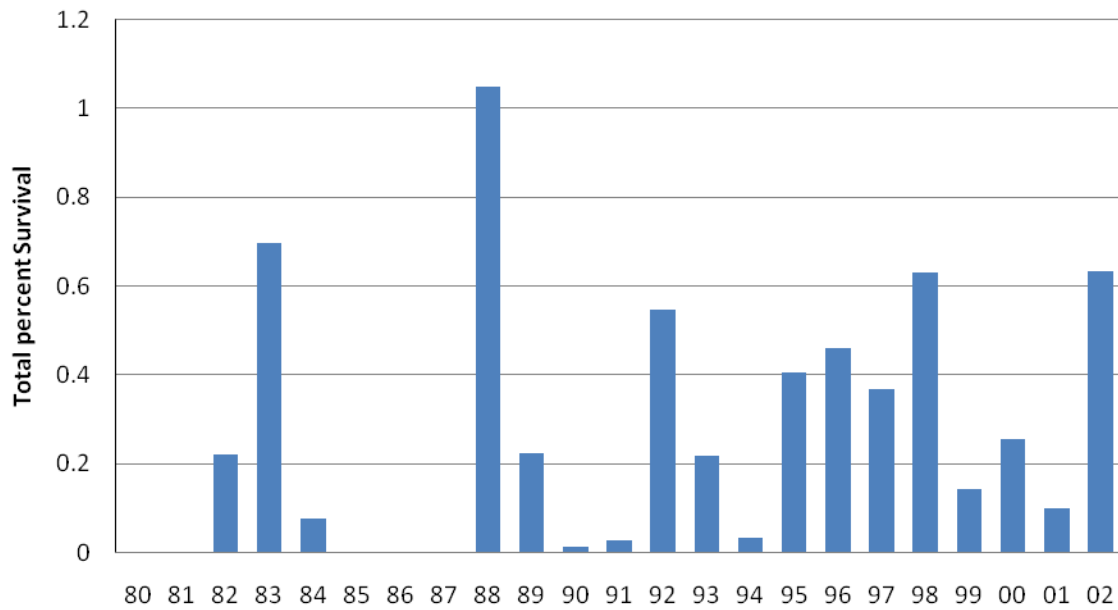
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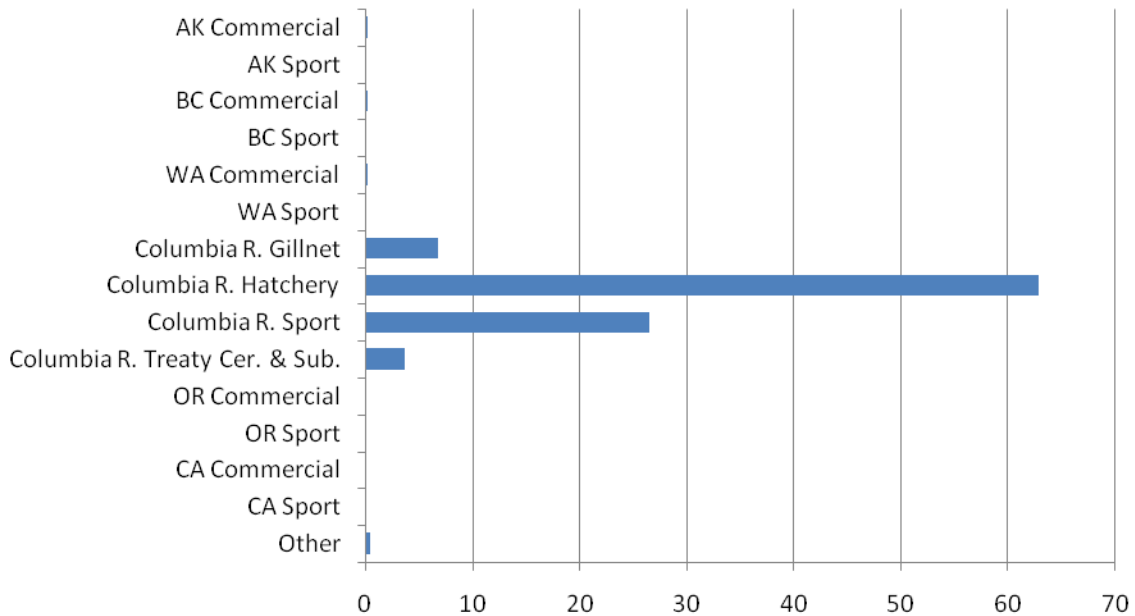
### Leavenworth NFH Spring Chinook yearlings



## Little White NFH Spring Chinook yearlings

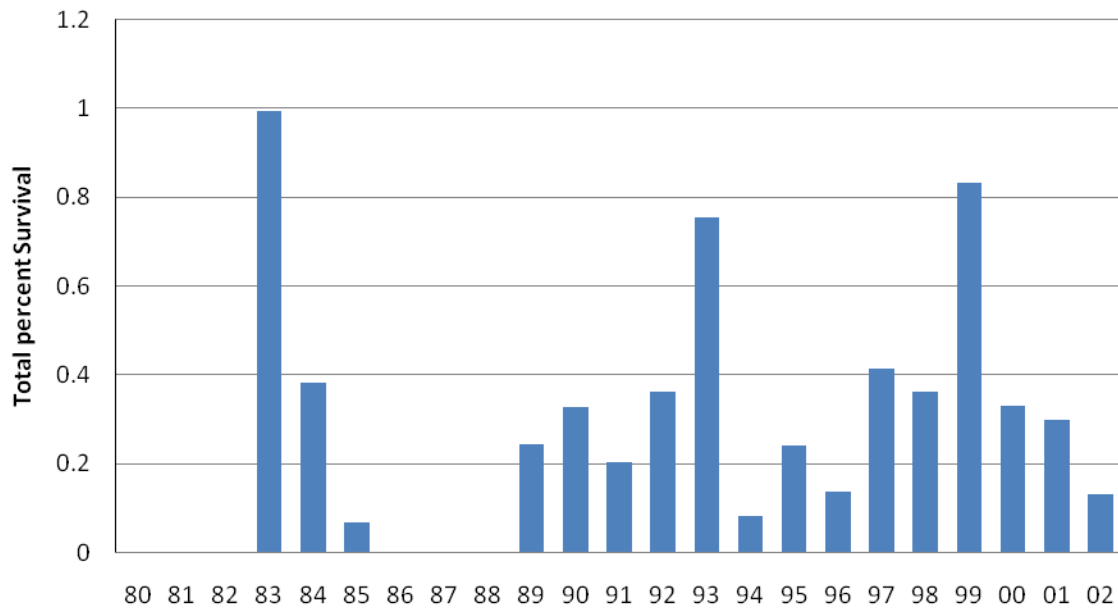


## Little White NFH Spring Chinook yearlings

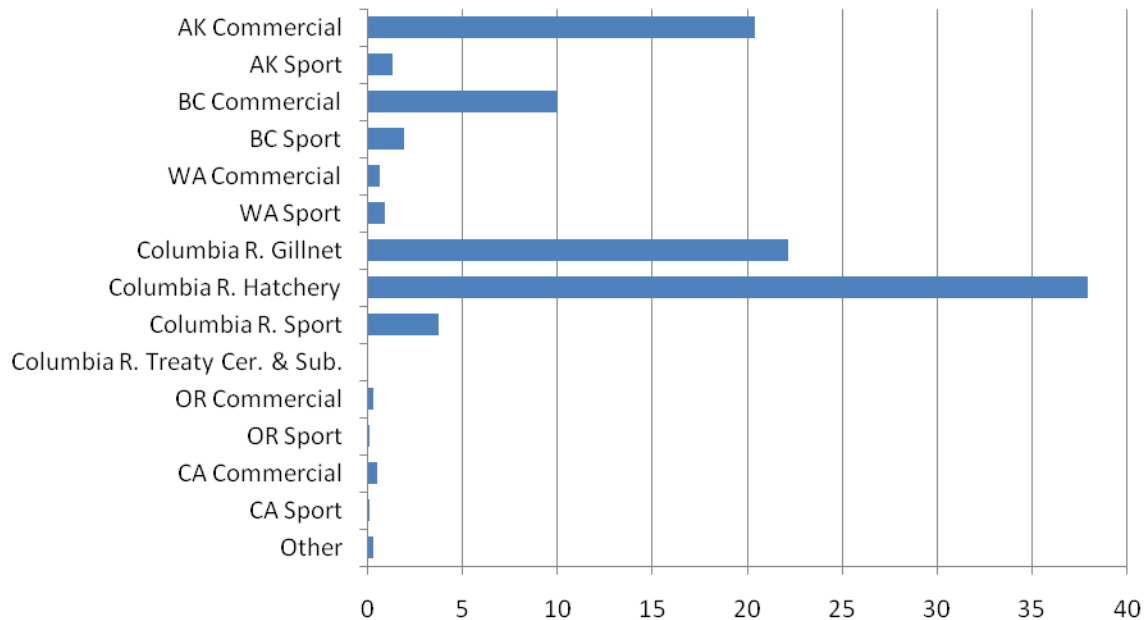




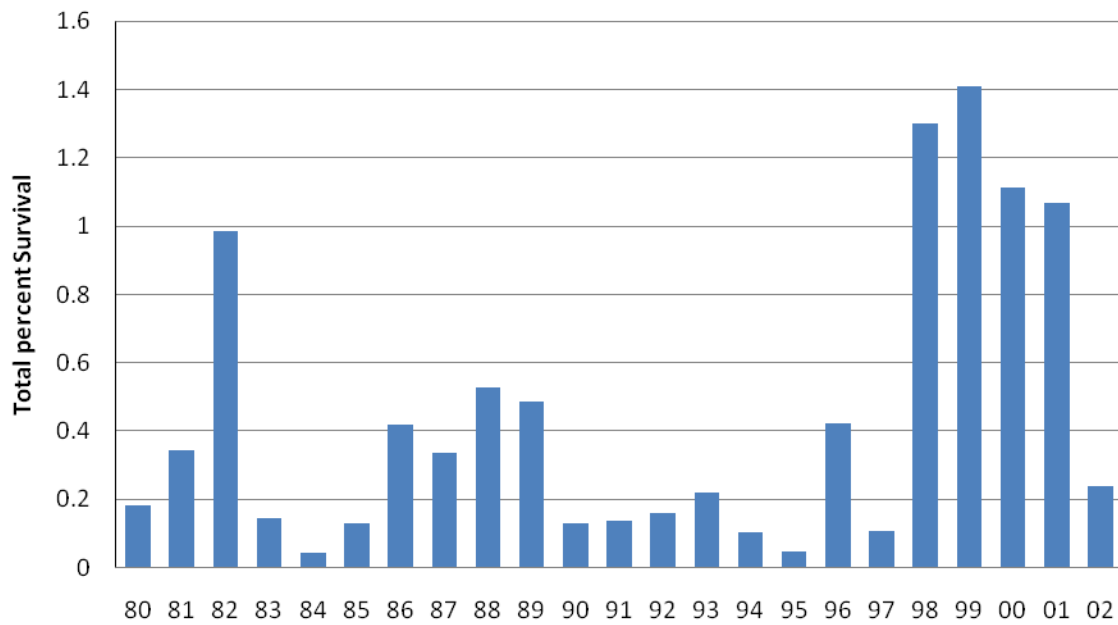
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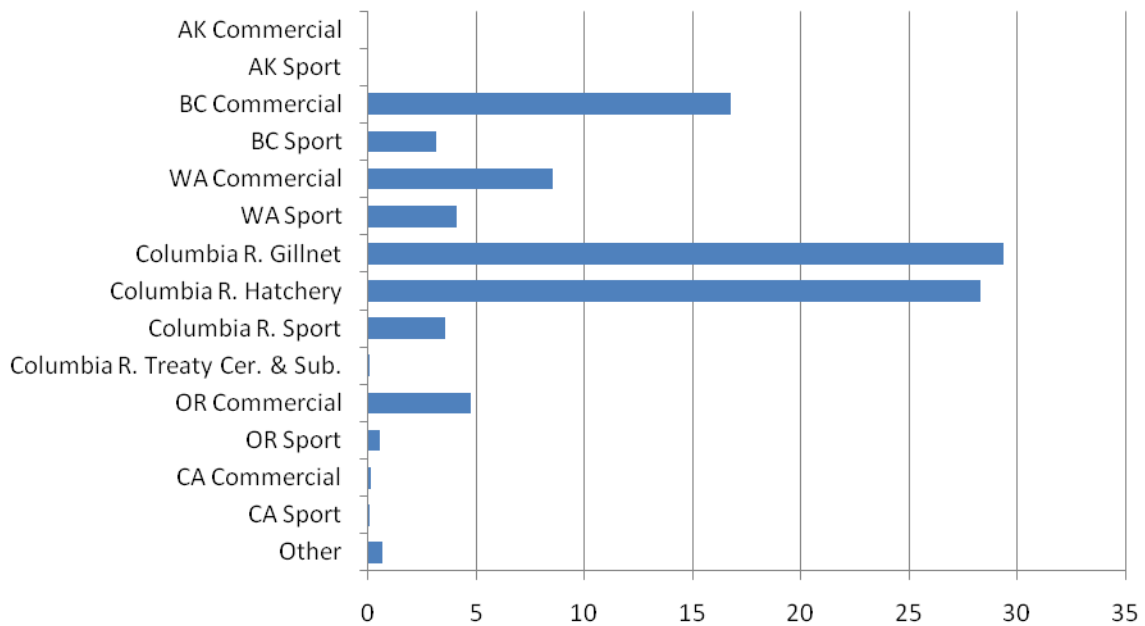
## Little White NFH Upriver Bright Fall Chinook fingerlings



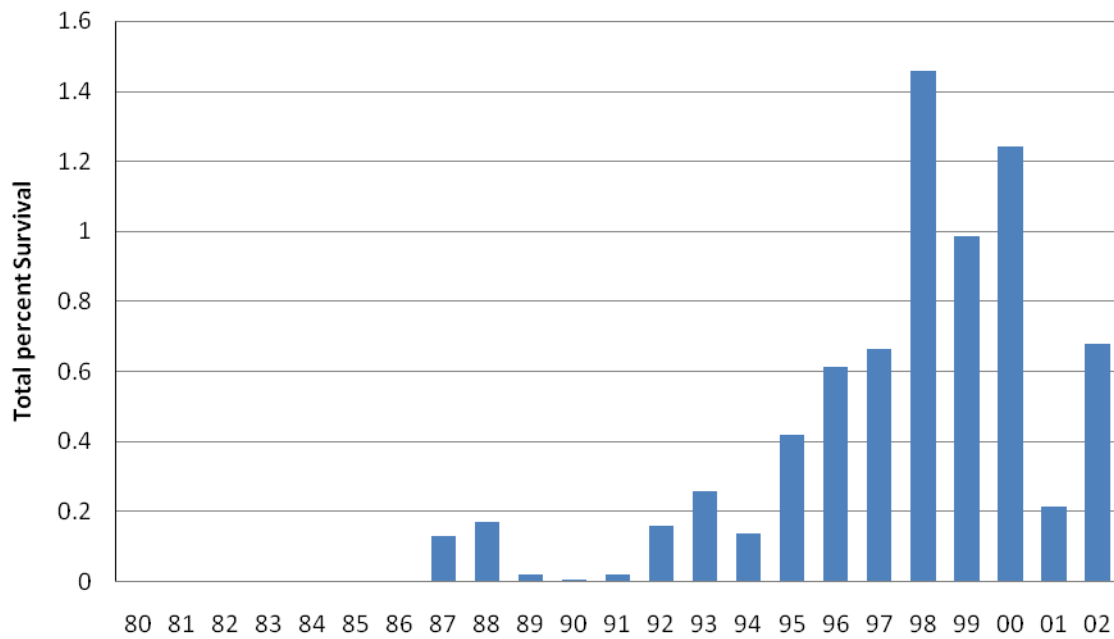
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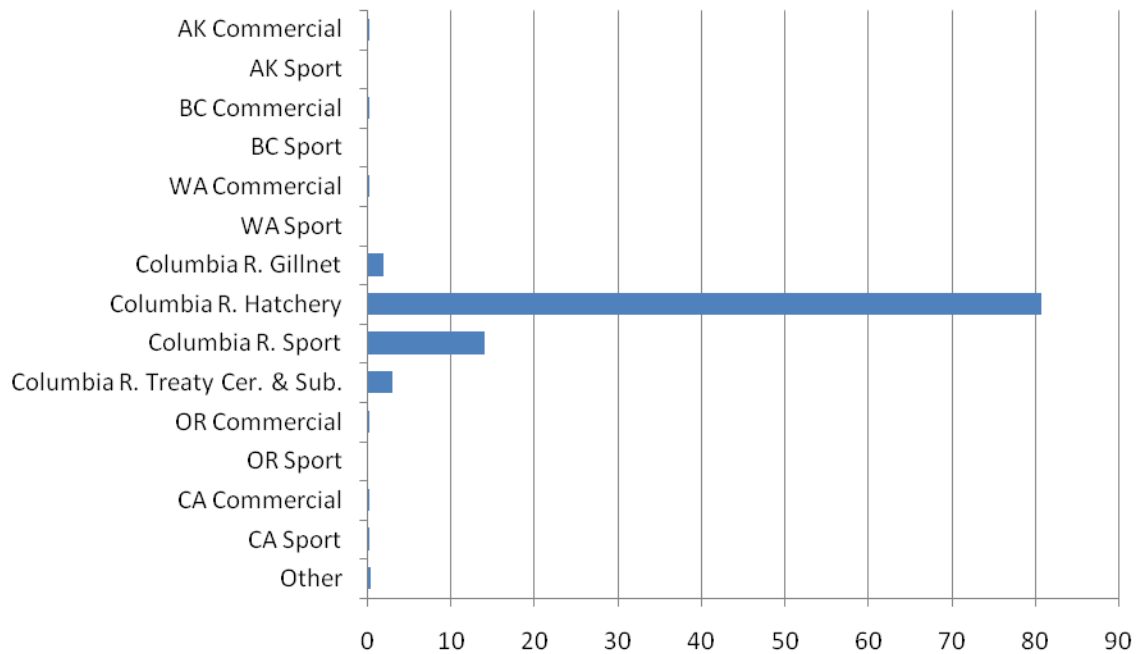
### Spring Creek NFH Tule Fall Chinook fingerlings



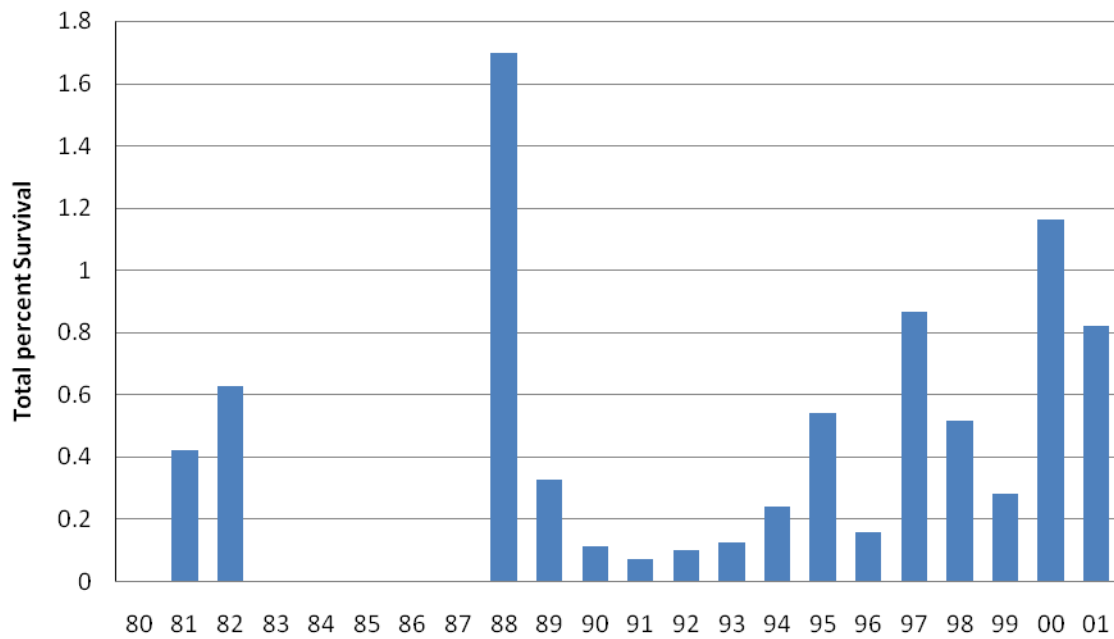
### Warm Springs NFH Spring Chinook yearlings



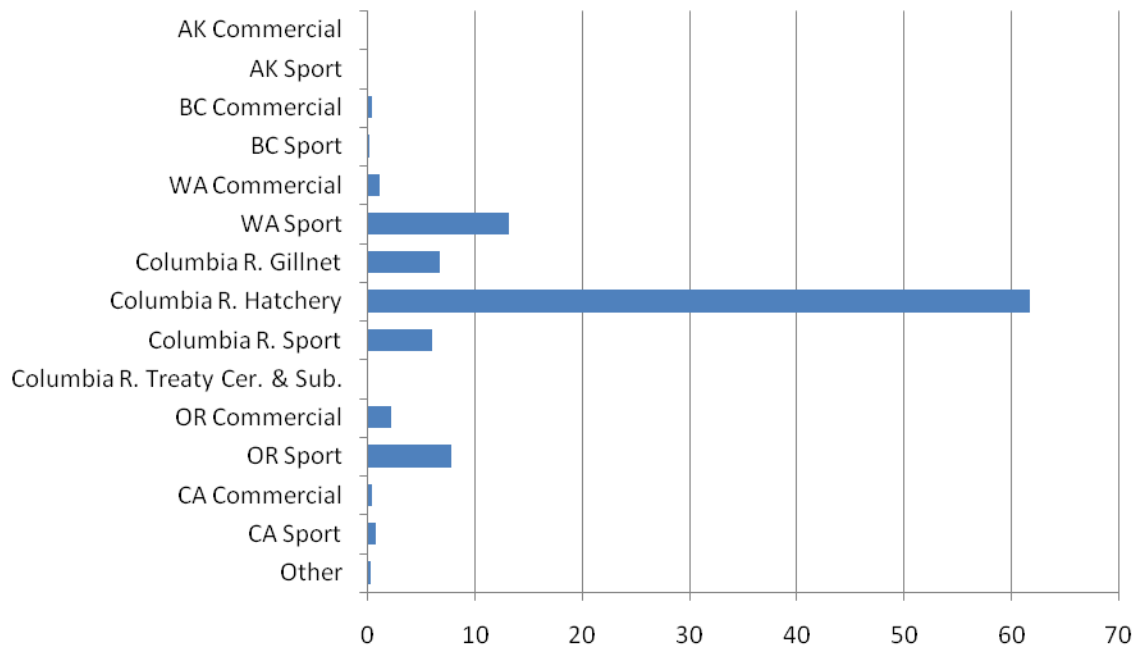
### Warm Springs NFH Spring Chinook yearlings



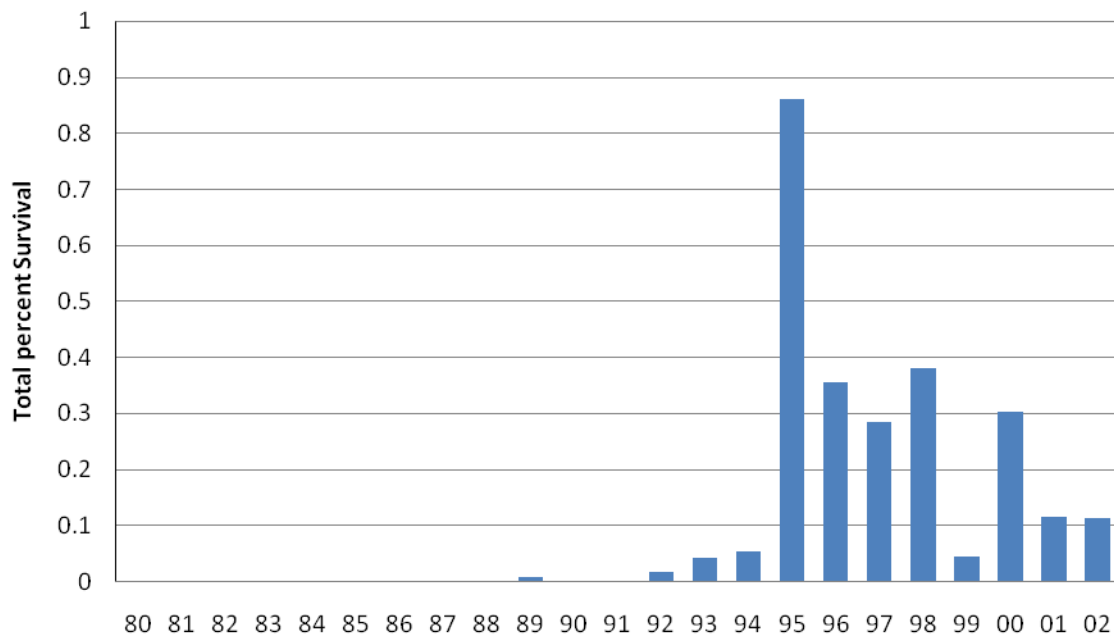
### Willard NFH Coho yearlings



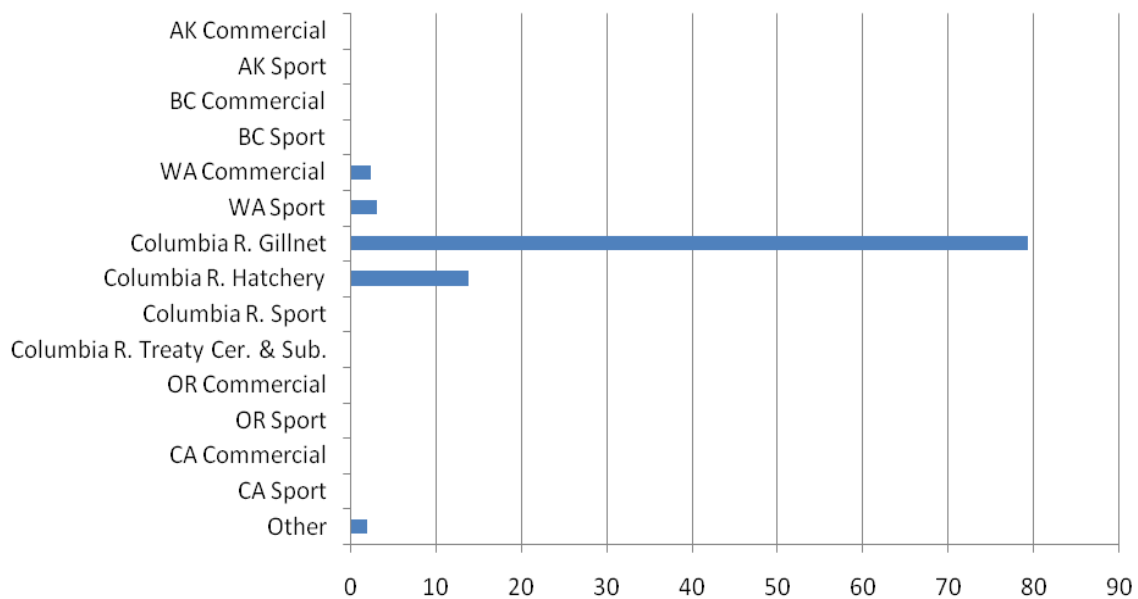
### Willard NFH Coho yearlings



### Winthrop NFH Spring Chinook yearlings



### Winthrop NFH Spring Chinook yearlings



## **Abernathy Fish Technology Center**

Abernathy Fish Technology Center (FTC) is located 14 miles west of Longview, Washington, on Abernathy Creek, approximately three miles upstream from its confluence with the Columbia River at an altitude of 175 feet above sea level. Abernathy FTC began operations in 1959. From 1980 through the 1990s, lower river tule fall Chinook were the only species reared on a production basis at Abernathy as part of Mitchell Act (NOAA Fisheries) funding.

Coded-wire tags were released in fish from brood years 1980 and 1981. Current estimated survival rates are 1.1511% and 0.2084%. Changes in reporting by the Canadian Department of Fisheries and Oceans (CDFO) were noted in the 1997 report. Nevertheless, the CDFO ocean troll fishery took most of these fish.

There were no releases of marked fish for brood years 1982 to 1988.

Marking fish with coded-wire tags was resumed for brood year 1989 under the Missing Production Group program. Brood year 1989 contributed mainly to troll and sport fisheries in Washington (1,628) and British Columbia (977). Overall survival was 0.1836% or 3,296 fish.

Fish from brood year 1990 had a low survival rate of 0.0746%. Approximately sixty thousand fish were released a month earlier and at one tenth the weight of fish represented by coded-wire tags. Therefore, the rd2 program was used to expand the contribution of each group of coded-wire tagged fish. An estimated 99 fish were taken in the ocean off Washington, and 130 in the Columbia River estuary sport fishery. An additional 645 fish were estimated to have been in Washington Department of Fish and Wildlife (WDFW) spawning ground surveys, based on 25 expanded recoveries.

Total survival is now estimated to be 0.2195% for brood year 1991. An estimated 1,156 fish were recovered in spawning ground surveys, nearly twice the number returning to Abernathy. Ocean harvest was 913 fish and 1,470 fish were harvested in the Columbia River.

Total survival for brood year 1992 is now 0.2455%. Hatcheries other than Abernathy recovered an additional 444 fish from the Columbia River contribution of 1,316. Of the 437 fish harvested in the ocean, 348 were in British Columbia.

Total survival for brood year 1993 is 0.2169%. There were 165 recoveries in the ocean, 528 in the Columbia River and 285 at the hatchery.

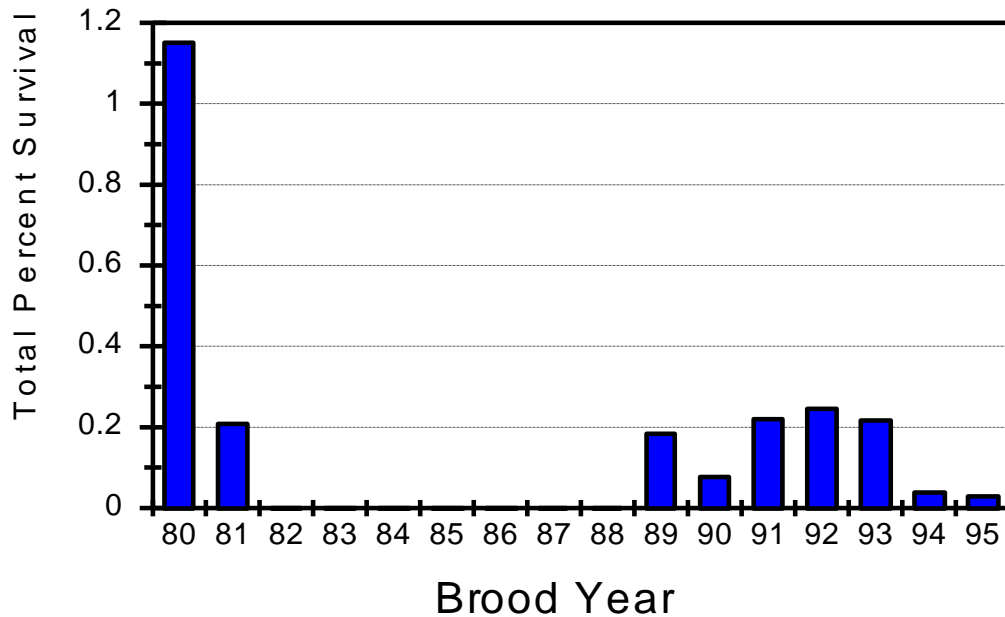
Brood year 1994 survival fell to an estimated 548 fish, or 0.0381%. WDFW hatcheries reported more recoveries than FWS.

There were only 8 observed recoveries of CWTs released with brood year 1995 fish, but four more than for the previous brood year. These recoveries are expanded to a total estimated contribution of only 298 fish from a release of 1,037,507 for an estimated survival of 0.0224%. The low survival rates for these two brood years are consistent with the low survival for fish released from Spring Creek NFH.

Release of tule fall Chinook occurred through brood year 1998 without coded-wire tags. Brood year 1998 was the last year production tules were released.

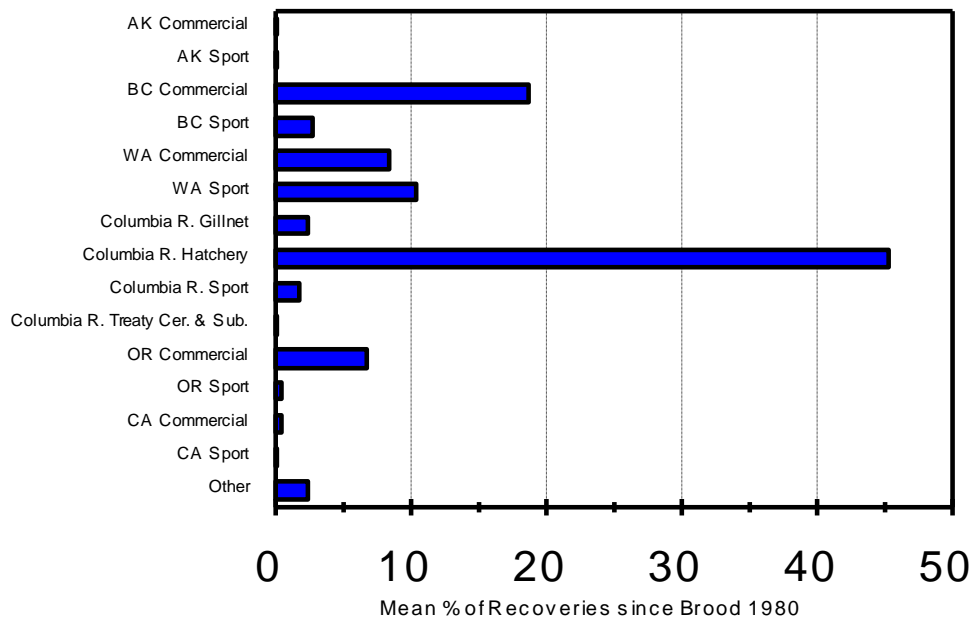
## Abernathy FTC

### Tule Fall Chinook fingerlings

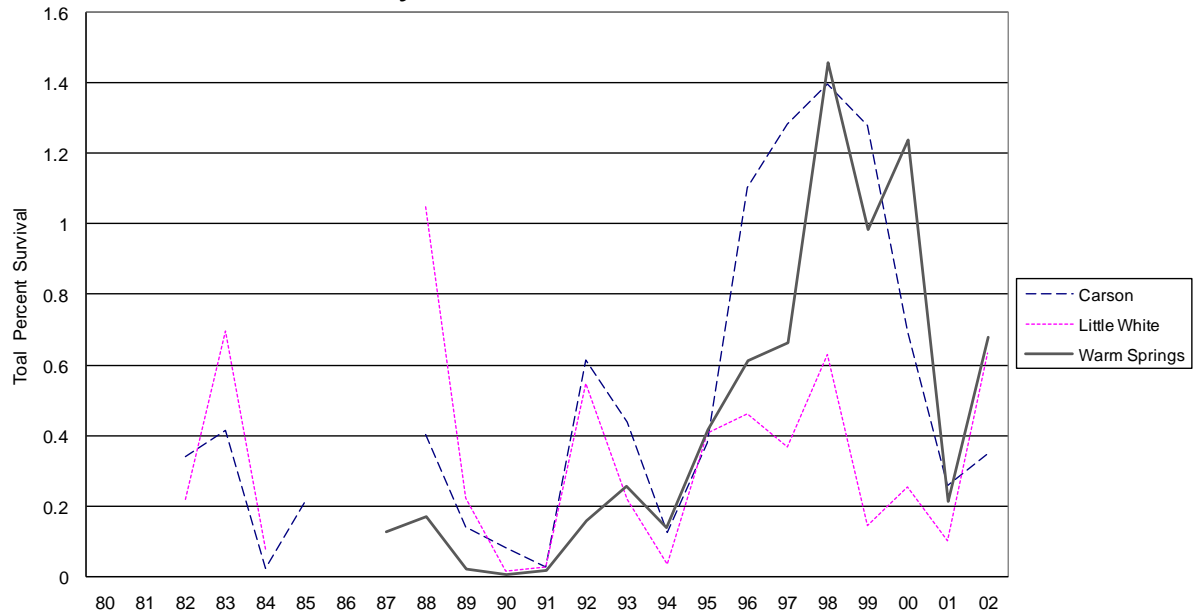


## Abernathy FTC

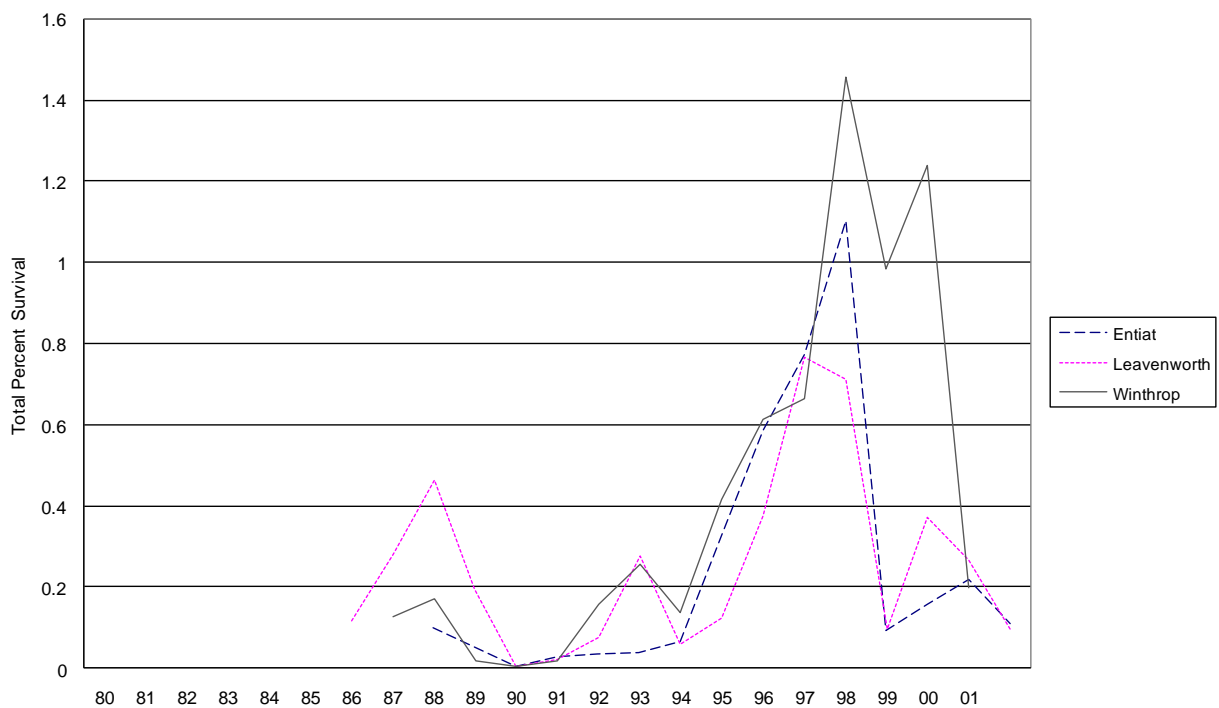
### Tule Fall Chinook fingerlings



## Lower River spring Chinook Survival by Brood Year



## Mid River spring Chinook Survival by Brood Year





Carson NFH spring Chinook yearling Releases and Returns

Brood Year	Number Released	Hatchery	Columbia River Harvest	Ocean Harvest	Spawning Ground	Total Recoveries	Smolt to Adult Survival
90	2,315,382	1,610	190	0	1	1,801	0.0778
91	2,321,285	450	92	0	12	554	0.0239
92	2,040,568	8,137	4,289	82	31	12,539	0.6145
93	2,195,192	4,720	4,825	42	8	9,595	0.4371
94	1,722,621	1,082	1,045	0	14	2,141	0.1243
95	907,708	2,425	997	0	0	3,422	0.3770
96	1,734,188	10,047	8,953	0	144	19,144	1.1039
97	1,415,744	8,086	9,890	14	168	18,158	1.2826
98	1,430,022	6,876	12,789	0	327	19,992	1.3980
99	1,608,684	7,218	13,067	0	327	20,612	1.2813
00	1,449,361	2,949	7,122	26	0	10,097	0.6967
01	1,673,255	1,819	2,428	21	0	4,268	0.2551
02	1,417,986	2,668	2,221	0	0	4,889	0.3448
03	1,470,134	1,584	241	0	0	1,825	0.1241

Dworshak NFH spring Chinook yearling Releases and Returns

Brood Year	Number Released	Hatchery	Columbia River Harvest	Ocean Harvest	Spawning Ground	Total Recoveries	Smolt to Adult Survival
90	959,369	22	4	0	0	26	0.0027
91	467,222	9	1	0	0	10	0.0021
92	1,278,273	688	56	0	3	747	0.0584
93	1,311,445	2,890	587	8	23	3,508	0.2675
94	102,903	59	20	3	1	83	0.0807
95	53,078	86	4	0	0	90	0.1696
96	973,400	3,410	901	0	2	4,313	0.4431
97	1,044,511	896	2,932	6	0	3,834	0.5949
98	1,017,873	3,338	5,333	24	40	8,735	0.8582
99	333,120	253	111	0	0	364	0.1093
00	1,000,561	2,864	2,295	47	0	5,206	0.5203
01	1,033,982	642	570	0	24	1,236	0.1195
02	1,074,009	1,217	679	0	96	1,992	0.1855

Dworshak NFH summer Steelhead yearling Releases and Returns

Brood Year	Number Released	Hatchery	Columbia River Harvest	Ocean Harvest	Spawning Ground	Total Recoveries	Smolt to Adult Survival
90	1,192,593	1,014	1,567	28	0	2,609	0.2188
91	1,224,101	486	1,096	25	0	1,607	0.1313
92	1,217,990	1,946	806	0	0	2,752	0.2259
93	1,410,283	2,432	643	0	0	3,075	0.2180
94	1,213,577	2,771	900	0	0	3,671	0.3025
95	1,377,435	2,007	615	0	0	2,622	0.1904
96	1,361,034	1,320	1,037	0	0	2,357	0.1732
97	1,228,944	2,821	1,451	0	0	4,272	0.3476
98	1,479,940	4,273	1,311	0	0	5,584	0.3773
99	1,427,083	4,344	2,712	0	0	7,056	0.4944
00	1,247,550	1,775	1,671	0	0	3,446	0.2762
01	1,365,623	1,828	582	0	0	2,410	0.1765

Eagle Creek NFH coho yearling Releases and Returns

Brood Year	Number Released	Hatchery	Columbia River Harvest	Ocean Harvest	Spawning Ground	Total Recoveries	Smolt to Adult Survival
90	1,087,346	429	310	596	0	1,335	0.1228
91	1,060,888	3,267	205	137	0	3,609	0.3402
92	980,327	3,696	215	1,109	0	5,020	0.5121
93	987,877	1,867	121	358	0	2,346	0.2375
94	996,618	1,423	66	263	0	1,752	0.1758
95	769,509	14,031	1,052	1,078	0	16,161	2.1002
96	1,010,044	13,249	1,566	2,549	0	17,364	1.7191
97	1,147,711	39,182	1,214	5,255	0	45,651	3.9776
98	1,006,688	30,964	8,351	9,966	174	49,455	4.9126
99	711,927	11,485	1,323	883	29	13,720	1.9272
00	508,321	6,887	452	524	20	7,883	1.5508
01	505,400	5,111	355	630	21	6,117	1.2103
02	557,016	7,502	487	584	0	8,573	1.5391
03	524,356	4,533	587	972	23	6,115	1.1662

## Entiat NFH spring Chinook yearling Releases and Returns

Brood Year	Number Released	Hatchery	Columbia River Harvest	Ocean Harvest	Spawning Ground	Total Recoveries	Smolt to Adult Survival
90	343,150	16	0	0	0	16	0.0047
91	376,462	96	9	0	0	105	0.0279
92	378,729	110	21	0	0	131	0.0346
93	391,211	144	6	0	0	150	0.0383
94	335,593	213	11	0	0	224	0.0667
95	200,486	647	8	3	0	658	0.3282
96	350,784	1,926	108	3	17	2,054	0.5855
97	354,238	2,277	442	0	20	2,739	0.7732
98	359,667	3,148	787	0	35	3,970	1.1038
99	397,855	311	32	0	28	371	0.0933
00	533,720	740	204	0	16	960	0.1591
01	395,689	699	166	0	8	873	0.2206
02	386,833	345	72	0	10	427	0.1104

## Kooskia NFH spring Chinook yearling Releases and Returns

Brood Year	Number Released	Hatchery	Columbia River Harvest	Ocean Harvest	Spawning Ground	Total Recoveries	Smolt to Adult Survival
90	727,251	61	16	0	0	77	0.0106
91	333,437	2	0	0	0	2	0.0006
92	305,813	90	9	0	0	99	0.0324
93	722,906	121	68	15	16	220	0.0327
94	333,794	0	9	0	0	9	0.0027
95	16,598	1	0	0	0	1	0.0060
96	43,165	381	26	0	1	408	0.9452
97	570,290	656	2,039	9	6	2,710	1.1573
98	365,150	852	1,878	0	68	2,798	0.7663
99	82,974	75	38	0	4	117	0.1410
00	549,861	719	927	16	25	1,687	0.3068
01	548,097	194	89	11	0	294	0.0536
02	591,380	450	294	12	6	762	0.1289

Leavenworth NFH spring Chinook yearling Releases and Returns

Brood Year	Number Released	Hatchery	Columbia River Harvest	Ocean Harvest	Spawning Ground	Total Recoveries	Smolt to Adult Survival
90	2,286,828	67	11	0	0	78	0.0034
91	1,757,931	360	14	0	0	374	0.0213
92	1,522,846	987	161	0	0	1,148	0.0754
93	1,712,648	3,477	1,200	0	30	4,707	0.2748
94	1,706,060	905	84	0	0	989	0.0580
95	919,025	811	248	0	73	1,132	0.1232
96	1,701,753	5,065	999	26	286	6,376	0.3747
97	1,636,402	5,677	6,120	0	762	12,559	0.7675
98	1,680,904	7,136	3,630	39	1,190	11,995	0.7136
99	1,630,089	814	665	0	88	1,567	0.0961
00	1,554,362	3,376	2,140	5	278	5,799	0.3731
01	1,288,893	2,620	705	16	81	3,422	0.2655
02	1,422,100	721	542	11	90	1,364	0.0959

Little White Salmon NFH spring Chinook yearling Releases and Returns

Brood Year	Number Released	Hatchery	Columbia River Harvest	Ocean Harvest	Spawning Ground	Total Recoveries	Smolt to Adult Survival
90	1,677,694	260	0	0	0	260	0.0155
91	809,079	232	0	0	0	232	0.0287
92	994,588	2,895	1,931	0	600	5,426	0.5456
93	1,057,864	1,246	1,055	0	0	2,301	0.2175
94	961,515	322	18	0	0	340	0.0354
95	682,623	2,381	339	0	56	2,776	0.4067
96	1,066,702	3,459	1,402	0	44	4,905	0.4598
97	1,074,173	576	3,358	0	24	3,958	0.3685
98	1,115,384	3,221	3,813	0	0	7,034	0.6306
99	1,016,574	480	990	0	0	1,470	0.1446
00	1,037,382	1,138	1,475	42	0	2,655	0.2559
01	1,012,339	527	498	0	0	1,025	0.1013
02	1,036,733	3,581	2,844	107	35	6,567	0.6334

Little White Salmon NFH upriver bright fall Chinook Releases and Returns

Brood Year	Number Released	Hatchery	Columbia River Harvest	Ocean Harvest	Spawning Ground	Total Recoveries	Smolt to Adult Survival
90	4,029,158	7,142	1,041	4,005	1,047	13,235	0.3285
91	2,862,783	2,461	1,146	1,426	804	5,837	0.2039
92	1,866,901	3,892	1,459	905	507	6,763	0.3623
93	1,797,922	6,678	1,576	3,306	1,980	13,540	0.7531
94	1,967,894	708	308	309	300	1,625	0.0826
95	2,097,206	2,634	407	1,213	825	5,079	0.2422
96	2,153,118	1,329	565	808	286	2,988	0.1388
97	1,999,435	1,918	2,503	1,334	2,520	8,275	0.4139
98	2,149,397	2,394	1,204	1,525	2,651	7,774	0.3617
99	1,970,592	2,207	2,066	4,892	7,220	16,385	0.8315
00	1,937,764	910	1,279	2,490	1,730	6,409	0.3307
01	2,074,295	1,406	1,572	1,607	1,650	6,235	0.3006
02	2,084,184	346	768	891	759	2,764	0.1326

Spring Creek NFH tule fall Chinook Releases and Returns

Brood Year	Number Released	Hatchery	Columbia River Harvest	Ocean Harvest	Spawning Ground	Total Recoveries	Smolt to Adult Survival
90	14,348,604	5,244	4,773	8,566	0	18,583	0.1295
91	19,072,355	9,417	7,844	8,938	9	26,208	0.1374
92	14,310,020	8,831	10,305	3,309	742	23,187	0.1620
93	15,607,856	10,471	18,212	5,279	325	34,287	0.2197
94	15,990,014	7,676	4,319	4,430	171	16,596	0.1038
95	16,440,491	3,418	2,403	1,821	440	8,082	0.0492
96	14,547,325	21,201	23,061	16,388	1,178	61,828	0.4250
97	15,619,429	5,943	6,308	4,721	0	16,972	0.1087
98	10,592,075	51,756	41,344	43,276	1,356	137,732	1.3003
99	16,065,945	68,983	70,881	78,415	7,884	226,163	1.4077
00	10,569,810	38,964	32,268	42,123	4,200	117,555	1.1122
01	16,117,906	68,303	35,759	63,845	4,479	172,386	1.0695
02	15,079,904	16,893	6,682	12,030	740	36,345	0.2410

Warm Springs NFH spring Chinook Releases and Returns

Brood Year	Number Released	Hatchery	Columbia River Harvest	Ocean Harvest	Spawning Ground	Total Recoveries	Smolt to Adult Survival
90	659,507	24	6	0	0	30	0.0045
91	557,014	85	9	0	0	94	0.0169
92	550,664	729	135	0	0	864	0.1569
93	398,142	891	125	5	0	1,021	0.2564
94	420,886	560	15	0	0	575	0.1366
95	467,427	1,864	79	3	0	1,946	0.4163
96	790,422	3,407	1,432	0	0	4,839	0.6122
97	811,570	3,692	1,687	11	0	5,390	0.6641
98	770,419	7,632	3,573	19	0	11,224	1.4569
99	827,665	6,933	1,202	7	0	8,142	0.9837
00	618,822	6,282	1,363	26	0	7,671	1.2396
01	655,740	1,145	247	7	0	1,399	0.2133
02	454,312	2,902	152	21	0	3,075	0.6768

Willard NFH coho Releases and Returns

Brood Year	Number Released	Hatchery	Columbia River Harvest	Ocean Harvest	Spawning Ground	Total Recoveries	Smolt to Adult Survival
90	1,569,287	385	258	1,079	0	1,722	0.1097
91	3,063,615	1,657	550	0	0	2,207	0.0720
92	1,992,332	1,486	161	360	0	2,007	0.1007
93	706,032	734	99	28	0	861	0.1219
94	2,354,413	4,558	285	759	0	5,602	0.2379
95	2,077,028	8,409	1,874	897	42	11,222	0.5383
96	1,797,749	2,328	415	72	34	2,849	0.1566
97	2,095,530	14,644	1,450	2,010	121	18,225	0.8639
98	1,546,084	3,182	1,883	2,887	513	8,465	0.5143
99	1,189,708	2,153	818	385	360	3,716	0.2821
00	969,412	5,031	1,949	4,522	498	12,000	1.1865
01	632,893	3,621	453	1,133	197	5,404	0.8227

Winthrop NFH coho Releases and Returns

Brood Year	Number Released	Hatchery	Columbia River Harvest	Ocean Harvest	Spawning Ground	Total Recoveries	Smolt to Adult Survival
02	308,063	13	68	5	3	89	0.0279
03	283,695	10	140	7	0	157	0.0553

Winthrop NFH spring Chinook Releases and Returns

Brood Year	Number Released	Hatchery	Columbia River Harvest	Ocean Harvest	Spawning Ground	Total Recoveries	Smolt to Adult Survival
90	624,771	8	0	0	0	8	0.0013
91	950,624	0	0	0	0	0	0.0000
92	556,313	20	74	0	0	94	0.0169
93	770,847	328	3	0	0	331	0.0429
94	112,395	59	1	0	1	61	0.0543
95	14,520	116	4	2	3	125	0.8609
96	324,851	939	83	3	131	1,156	0.3559
97	545,062	583	916	3	44	1,546	0.2836
98	377,696	678	568	5	189	1,440	0.3813
99	175,869	53	11	6	8	78	0.0444
00	201,604	452	27	0	134	613	0.3041
01	461,678	347	52	0	134	533	0.1154
02	578,307	420	40	0	196	656	0.1134

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<sup>i</sup>Eagle Creek National Fish Hatchery Station Development Plan 1983

<sup>ii</sup> Environmental survey report pertaining to salmon and steelhead in certain rivers of eastern Oregon and the Willamette River and its tributaries: Pt. II. Survey reports of the Willamette River and its tributaries. Fish Commission of Oregon, Research Division Willis, Raymond A, Melvin D Collins and Roy E Sams Oregon. Fish Commission. Research Division 1960

<sup>iii</sup> Assessments to Determine the Effect of Current and Alternate Ladder Operations on Brood Stock Collection and Behavior of Hatchery Fall Chinook Salmon at Little White Salmon National Fish Hatchery During 2004-05

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August 14, 2006

<sup>iv</sup> Assessments to Determine the Effect of Current and Alternate Ladder Operations on Brood Stock Collection and Behavior of Hatchery Fall Chinook Salmon at Spring Creek National Fish Hatchery during 2003-2005

U.S. Fish and Wildlife Service

Rod Engle and Doug Olson

Columbia River Fisheries Program Office

Larry Marchant and Mark Ahrens

Spring Creek National Fish Hatchery

2003-2005 ladder closures

Two closures were planned for the 2004 and 2005 hatchery return (Table 2). These closures were planned to occur during weekends near the beginning and peak of the hatchery return. Closures began near 1:00 PM on Fridays and ended near 1:00 PM on Sundays.